CESPK-ED-M (1110) 15 June 1998

MEMORANDUM FOR RECORD

SUBJECT: Corps Specifications Steering Committee Meeting Minutes

1. The Corps Specifications Steering Committee (CSSC) met on 7-8 April 1998 in Arlington, Texas.

2. Announcements. Freddie Rush opened the meeting with the introduction of new committee members. Nadine Miyahira, CEPOD-ED-DA, was present in proxy for Wayne Hashiro. Enclosure 1 is the list of attendees.

3. Mr. Rush reviewed the proposed agenda (enclosure 2). A minor change in the order of business on 8 April 1998 was needed and dredging specifications will be under New Issues for Discussion.

4. The minutes of the 22-23 January 1998 Committee Meeting in Arlington, Texas, were approved as read by motion of Joe Miller, second by Rick Dahnke, and unanimous vote.

5. HQUSACE Comments.

a. Mr. Rick Dahnke reported on the 19-21 May 1998 meeting of the SPECSINTACT Subcommittee to resolve differences in the submittal processes of Army, Navy and NASA. He provided a copy of the Tri-Service Working Group Report to the Congressional Defense Committees on Unified Design Guidance (enclosure 3). Mr. Dahnke stated the DoD Standard Procurement System (SPS) will be field tested beginning October 1998. SPS version 4 will be tested at HQ USACE this month. Rick also said that CEMP will not fund CSSC activities. The Criteria Document Update Program (CDUP) continues to perform the work of the CSSC for Military Design.

b. Charles Baldi reported that he sent a letter on the issue of the dredging specification but has received no real comments to date.

6. SPECSINTACT Interagency Configuration Control and Coordinating Board (SI-CCCB) Meeting Update.

a. Mr. Jim Quinn reported that current SPECSINTACT has become very stable. SI-CCCB is looking to improve the program features in a 32-bit version. They are also trying to bring the Army, Navy and NASA together on specification issues.

b. Mr. Tom Shaw Tailoring options will also improve SPECSINTACT utilization to edit on importing sections to Jobs and expedite the editing of specifications. Notes will provide information on selecting tailoring options from a screen displaying all available options. Tailoring options will have to be executed before converting jobs to WordSpec.

c. Tom said the 32-bit version of SPECSINTACT should be ready for release within a year. A PDF feature will not be added to SPECSINTACT. George Norton asked if the erratic page break feature will be fixed. The current 16-bit version will only be maintained by fixing any bugs that may pop up.

d. The Construction Criteria Base (CCB) search feature has been improved on Issue #43. CCB is proceeding with the DVD format capable of holding 9.8 GB on each side. CCB and SPECSINTACT both have sites on the Internet.

e. DrawSpec was demonstrated with a 6500-keyword database. The program was developed by a private firm. Navy and Tri-Service are evaluating DrawSpec.

f. Resident Management System (RMS) uses a comma separated values (CSV) to transfer data such as the submittal register produced by SPECSINTACT.

7. Report on Joint Specifications Engineering Regulation (ER). Mr. Ray Duncan presented a combined Specifications Engineering Draft ER for both the

Military and CW. He identified the differences in ER 1110-2-1201 for CW specifications and Military Specification guidance in ER 1110-345-700, Design Analysis, Drawings, and Specifications, Appendix D, 30 May 1997 as compared to the proposed wording of the new ER. Ray presented major issues pertaining to philosophical differences, perception of the CSSC and funding. Minor differences in outline specifications (enclosure 4), preliminary bid schedule, HTRW, design and construction phases and planning for predesign. General discussion ensued on these issues and strategies to address them. Issues at an impasse will be forwarded to HQ. GEN Ballard may be briefed for guidance and forwarding to a Campaign Team, possibly Team 6, Division and District Processes. Comments provided by CEMP-ET expressed major concerns about the basic approach and content of this draft ER (enclosure 5). We continued the review of the Draft ER and Ray will incorporate comments in a revised draft for our next meeting.

8. Committee Name. Mr. Jim Quinn moved that the committee name be changed to Construction Specification Steering Committee. The committee was not in favor of the change, but Freddie Rush will investigate the charter in conjunction with Campaign Team 6.

9. Notice Program Proposals.

a. HESC Notice Program Proposal. Mr. Quinn stated the Notice Program at CEHNC addressed more than just CEGS. The program also includes TECHINFO, the Single Master Reference List (SMRL), CCB coordination. Three technicians support this program along with the Engineer Technical Representatives. There will be no change in the Criteria Document Update Program for both CW and Military. The HESC Notice Program requires about $70,000 per year projected program funding after consolidation.

b. MVK Notice Program Proposal. Mr. Tom Shaw provided an information paper on the current CWGS Notice Program and the effect combining the Notice Programs and operating them from CEMVK-ED-DE (enclosure 6). He summarized the current program costs to be approximately $100,000 per year with 1.3 FTE to support it. Managing the combined Notice Program at MVK would require approximately $360,000 per year. Ninety percent of technical representatives are located at CEMVK.

c. The committee decided not to recommend any change the programs for the time being.

10. Submittals and Descriptions. The purpose of the Submittal Descriptions was again called into question, but no change in our previous decision was made.

11. Amendments in SPECSINTACT. The presentation Steven Freitas made at the SI-CCCB meeting addressing the need for program modifications in SPECSINTACT to support amendments in specifications was well received (enclosure 7). EG&G programers were supportive and will write a requirement analysis for the next SI-CCCB meeting. Changes will be incorporated into the 32 bit application if the decision is made to proceed with this proposal.

12. Mechanically Stabilized Earth (MSE) Walls GS. Mr. Al Geisen presented information on the use of MSE walls in the St. Paul District and the savings realized (enclosure 8). The proposal for ETL will be presented to HQ USACE.

13. Recommendation No 12. Recommendation No 12 is to support the establishment of an annual jointly sponsored by Construction Specification Institute (CSI) and Society of American Military Engineers (SAME) federal specifications competition and award (enclosure 9). Mr. Duncan reported that SAME and CSI

are coordinating to inform GEN Ballard of their intentions to support this recommendation.

14. Updates of CWGS & CEGS

a. CWGS 02542 (CE 1308), Stone Protection. There was concern expressed that the section did not address coastal protection. This GS will be based on existing scope and will not include Coastal Stone Protection. Mr. Charlie Baldi will discuss this issue with Art Waltz.

b. CE 1309, Levees. Tom Shaw will review HQ comments and call Charlie Baldie with response.

c. Concrete Restoration, Rock Anchors and Soil Anchors. Pittsburgh District has provided proposals with time and cost estimates on these sections. See enclosure 10 for the proposal on Concrete Restoration and enclosure 11 for the proposal on Soil and Rock Anchors. CELRD-OR-ET-E has also submitted a proposal on Soil and Rock Anchors (enclosure 12).

d. Gabion Specification. Mr. Baldi reported there is $30,000 for needed data, but won't be able to pay at this time.

e. CE 1102, Dredging. See enclosure 13 for the CECW-EP MEMORANDUM, dated 31 March 1998, that eliminates the Dredging GS. Forward all calls for a Dredging GS to Barry Holiday.

15. New Issues for Discussion.

a. Mr. Larry Seals provided an information paper on Hydraulic Steel Structures Requirements for our review (enclosure 14).

16. Next Meeting. Our next meeting will be the week of 15-17 or 22-24 June 1998 in Arlington, TX. Freddie will notify the committee when arrangements are made. We are to review organization of guide specifications from TECHINFO.

17. There being no further discussion or business for the Committee to consider, we adjourned the meeting.

Steven P. Freitas
Secretary, CSSC

14 Encls
1. Attendance
2. Agenda
3. Unified Design Guidance
4. Outline Specifications
5. CEMP-ET Draft ER Comments
6. MVK Notice Program Proposal
7. Amendments in SPECSINTACT
8. MSE walls
9. Recommendation No 12
10. Concrete Restoration Proposal
11. Soil and Rock Anchors Proposal
12. Soil and Rock Anchors Proposal
13. CECW-EP MEMORANDUM
14. Hydraulic Steel Structures

CORPS SPECIFICATIONS STEERING COMMITTEE
Meeting Attendance
Arlington, Texas.
7-8 April 1998

1.	Charles Baldi	CECW-EP	(202) 761-8894
2.	Rick Dahnke	CEMP-ET	(202) 761-1203
3.	Jim Quinn	CEHNC-ED-ES-G	(205) 895-1821
4.	Larry Seals	CELRD-OR-ET-EQ	(513) 684-3034
5.	Thomas R. Shaw	CEMVK-ED-DE	(601) 631-5579
6.	Freddie S. Rush	CEMVD-ET-ET	(601) 634-5936
7.	Al Geisen	CEMVP-PE-D	(612) 290-5522
8.	George H. Norton	CENAE-EP-DG	(617) 647-8870
9.	Joe Miller	CENWD-MRR	(402) 697-2649
10.	Nadine Miyahira	CEPOD-ED-DA	(808) 438-7046
11.	Tim Pope	CESAD-ET-EG	(404) 331-6703
12.	Donald L. Bergner	CESPD-ET-ET	(415) 977-8101
13.	Steven P. Freitas	CESPK-ED-M	(916) 557-7296
14.	A. Ray Duncan	Spec Consultants, Inc.	(601) 638-8958

ENCLOSURE 1

AGENDA

CORPS SPECIFICATIONS STEERING COMMITTEE

TUESDAY, 7 APRIL 1998

0800 - 0810	Announcements	Freddie Rush
0810 - 0815	Review Agenda	Committee
0815 - 0825	HQUSACE Comments	Baldi/Dahnke
0825 - 0835	Review and Approve Minutes of Previous Meeting	Committee
0835 - 0850	SI-CCCB Update	Shaw/Quinn
0850 - 0930	Report on Joint ER	Ray Duncan
0930 - 1000	Discussion on Joint ER Report	Committee
1000 - 1015	Break	
1015 - 1045	HESC Notice Program Proposal	Jim Quinn
1045 - 1115	MVK Notice Program Proposal	Tom Shaw
1115 - 1145	Discussion on Notice Program	Committee
1145 - 1245	Lunch	
1245 - 1300	Committee Name	Committee
1300 - 1315	Renumbering CEGS	Committee
1315 - 1400	Submittals & Descriptions	Committee
1400 - 1430	Organizational Guidance	Committee
1430 - 1500	Amendments in SPECSINTACT	Steve Freitas
1500 - 1515	Recommendation No. 12	Committee
1515 - 1530	Break	
1530 - 1615	Resumes for New Members	Committee
1615 - 1645	SPS & CSI Format	Committee
1645 - 1700	Summary	

WEDNESDAY, 8 APRIL 1998

0800 - 0815	Recap	Freddie Rush
0815 - 0835	Consolidate Environmental GS	Committee
0835 - 0855	Mech Stabilized Walls GS	Al Geisen
0855 - 0915	Rock & Soil Anchors GS	Larry Seals
0915 - 0925	Fracture Critical Members	Larry Seals
0925 - 0945	Drainage Structures GS	Freddie Rush
0945 - 1000	Break	
1000 - 1015	Revise Gabion GS	Freddie Rush
1015 - 1030	Expand Stone Protection GS	Freddie Rush
1030 - 1045	CEGS/CWGS Consolidations	Committee
1045 - 1115	Prioritize Work on GS	Committee
1115 - 1145	New Issues for Discussion	Committee
1145 - 1200	Summary	Committee

Tri-Service Working Group

March 1998

Report to the Congressional Defense Committees

UNIFIED DESIGN GUIDANCE

Executive Summary

House Conference Report 105-247, dated 9 September 1997, directs the DoD Services to prepare a joint report by 31 March 1998 which identifies:

(1) Areas where uniform procedures, systems, and/or criteria are already in use
(2) Other possible areas where it may be practical to create more uniformity
(3) The most cost-effective system for implementing improvements

A Tri-Service Working Group evaluated the status of unified design guidance and analyzed options to implement further improvements. The Working Groups findings and recommendations are:

(1) Forty-three percent of the Services existing design criteria documents are “unified”, and current initiatives will unify another four percent. The Services use a common guide specification system, many of the same design tools and databases, and are working together to develop standard designs for common types of facilities.
(2) There is potential for unifying more systems and the majority of the fifty-three percent of the Services design criteria documents that are not already unified. There is also potential to expand the existing uniformity of the Services guide specification system.
(3) Greater use of Tri-Service groups as a formal documented process is the most cost-effective system for implementing improvements in unifying design guidance based on the analysis performed by the Tri-Service Working Group.

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1. Background

Language on *Unified Design Guidance* in House Conference Report 105-247, 9 September 1997, directs DoD and the Services to submit a joint report to the congressional defense committees by 31 March 1998 which identifies (1) areas where uniform procedures, systems, and/or criteria are already in use; (2) other possible areas where it may be practical to create more uniformity; and (3) the most cost-effective system for implementing improvements either through a greater use of Tri-Service groups; centralized development and management under one of the Services with design and construction authorities; or centralizing the development and management of design guidance under the Secretary of Defense.

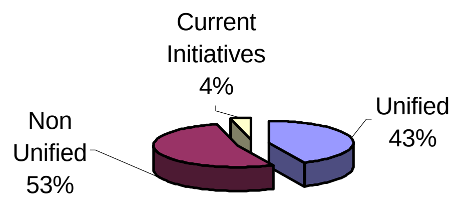
2. Approach

The three Services, with OSD concurrence and support, established a Tri-Service Working Group (TWG) to address “unified design guidance”. The TWG surveyed existing procedures, systems, and criteria affecting design and construction for the three Services, evaluated the extent of existing uniformity of this guidance, identified areas where greater uniformity is practical, analyzed viable options for future management of uniform guidance, and prepared this report of the findings.

3. Question (1) – Areas Where Uniform Procedures, Systems and Criteria Are Already In Use

The Tri-Service Working Group surveyed all of the Services’ existing design guidance to determine where uniform procedures, systems and criteria are in use.

Forty-three percent of the Services’ existing design criteria documents are “unified”. This figure includes documents that are Tri-Service, Dual-Service for which the other Service has no need, Dual-Service which have some potential for use by all the Services, and Single-Service unique for which the other Services have no need. An additional four percent of the Services criteria will be unified as a consequence of current initiatives. Appendix II summarizes the current status and baseline for achieving further standardization among the Services.



Design Criteria

Appendix III describes other areas where uniform procedures, systems and criteria are already in use. The key areas are:

- SPECSINTACT guide specification system
- CADD/GIS, computer-aided design and drafting/geographical information systems
- Cost engineering
- Value engineering
- Design tools
- Standard designs
- Criteria distribution
- Commercial consensus codes and standards

4. Question (2) - Areas Where It May Be Possible to Create More Uniformity

There is considerable uniformity among the Services. The Tri-Service Working Group strongly believes it is possible and realistic to create more uniformity. Those areas with the most potential are described below.

A. Design Criteria

While forty-three percent of the Services' design criteria are already unified, and an additional four percent are being unified, there is potential to unify most of the remaining Service criteria. Ongoing efforts of the Services functional and discipline working groups are directed to continue criteria unification to the maximum extent possible.

B. Construction Guide Specifications

The Tri-Service Working Group chartered a Subcommittee for Unified Construction Guide Specifications to evaluate the potential for developing a single guide specification system for all the Services. The Subcommittee reviewed current practices of the three Services, found a high degree of uniformity in the Services specification systems, and determined that there are opportunities for continuing efforts to maintain and promote that uniformity. The Subcommittee determined that the most cost-effective means for implementing improvements to the development of a unified construction guide specification system is through Tri-Service groups. This will encourage the shared use of resources under organizations already in place, eliminate the need for additional layers of authority or bureaucracy and maximize use of the combined corporate knowledge of the Services technical experts actually involved in day-to-day problem solving during the design and construction process. Ultimately, major expansion of this established Tri-Service relationship is the best approach to achieve a unified specification system and still retain the flexibility each Service needs to be responsive to its own missions and user requirements. The complete Subcommittee report is provided in Appendix IV.

C. Design Guidance to Implement Programs And Policy from Higher Authority

Developing design guidance to implement programs and policy from higher authority is an area where it is possible to create more uniformity. Emerging policy on issues such as energy conservation, global warming, sustainable design, “green buildings”, and the environment can be implemented through unified design guidance developed by the collective talent of all the Services.

D. Additional Study

The Tri-Service Working Group is working with national private sector architect/engineering and construction groups to gain their perspectives on where and how unified design guidance can add value to the acquisition process for military facilities. Results, while not available at the time of this report, will be used to prioritize future development of unified design guidance. Furthermore, the Tri-Service Working Group Model for Unified Design Guidance (Appendix I) Implementation Plan of Action and Milestones provides a more detailed analysis of the Services processes for design guidance. Greater unification will be evaluated in areas such as lessons learned, shared technical training, and interagency assignments.

5. Question (3) - The Most Cost-Effective System For Implementing Improvements

The Tri-Service Working Group investigated three options for implementing improvements in the unified design guidance process: Option (1) - greater use of Tri-Service groups; option (2) - centralized development and management under one of the Services with design and construction authority; and option (3) - centralized development and management of design guidance under the Secretary of Defense.

A. Option (1) - Greater Use of Tri-Service Working Groups

The first option for implementing improvements is through expanded use of Tri-Service working groups. Tri-Service working groups composed of existing Services technical personnel have proven to be a cost-effective way to develop Air Force, Army, Navy and Marine Corps facilities design criteria. The working groups will further unify the main body of criteria documents (manuals, handbooks, publications, specifications, standard designs, etc.) through a structured process by all the Services. Criteria documents will be streamlined by using commercial and national non-government standards whenever possible. Design guidance will be current and effectively implement laws, regulations, executive orders and DoD policies, introduce new and innovative technology, and define the level of quality required for facilities to support mission requirements throughout their life cycle.

The Services have achieved a high degree of uniformity by using the collective talent of all the Services in existing working groups. There are seventeen Tri-Service, two Dual-Service and nine Single-Service existing working groups that coordinate, develop, and implement unified design guidance as part of their charters. Two Dual-Service and nine Single-Service working groups have potential to include all three services. A list of these groups is included in Appendix III.

Many of the Tri-Service groups are already working to introduce new technology, solve field problems, share lessons learned, determine functional and mission requirements, and implement laws, executive orders and DoD policy. It is appropriate to continue and expand this process for development of unified design guidance.

B. Option (2) - Centralized Development And Management Under One of the Services

A second option for implementing improvements is for one of the Services with design and construction authority to develop and maintain all engineering and design guidance.

Each Service has developed specialized technical expertise based on its core mission. For example, the Army is the technical lead for airfield and roadway pavements, the Navy is the lead for piers, wharves and moorings, and the Air Force provides specialized expertise in aviation navigational aids. The architectural and engineering experts throughout each of the Services participate in the development of design guidance. Consolidating development of design guidance under one Service would result in a loss of available specialized expertise and would not be efficient or cost-effective. Furthermore, the guidance would in general not be as good as that prepared with the collective technical input of all of the Services.

Also, each Service must have the capability to rapidly respond to engineering and design-related questions, to implement new and innovative technology into facilities, and to modify design guidance when necessary to address mission readiness and health and safety issues. This agility would be lost with the criteria function centralized under one Service.

The Services are accelerating the use of new methods of facilities acquisition and contracting. These methods require different types of technical criteria and in various formats. Centralizing criteria under one Service would not provide a mechanism to be responsive to the rapidly changing needs of each Service.

C. Option (3) - Centralized Development And Management Under The Secretary of Defense

The third option for implementing improvements is to centralize the development and management of design guidance under the Secretary of Defense. The Office of the Under Secretary of Defense (Industrial Affairs & Installations) would have primary responsibility for establishing and maintaining unified design and construction criteria for the Services. This method, however, has the same disadvantages noted above of using a single Service.

In fact, OUSD (IA&I) would have to rely on the technical expertise currently available in the private sector; existing technical expertise from the U.S. Army Corps of Engineers, the Naval Facilities Engineering Command, the Air Force Civil Engineer; and ultimately existing Tri-Service committees. This would result in increased costs to prepare and revise criteria. There are few advantages to having design guidance managed under the Secretary of Defense.

OSD's primary responsibility is development of national defense policy. Central criteria management of detailed technical criteria may be an inappropriate role, adds another layer of bureaucracy to the process, does not eliminate the need to issue Service-specific supplements to criteria, and will decrease responsiveness to the working level users in the Services.

D. Analysis of the Most Cost-Effective Option

The Tri-Service Working Group evaluated the three options based on a set of key objectives. The key objectives in priority order are:

- <u>Technical Quality</u> – design guidance is accurate, up-to-date, ensures safety and health of Service members and the public, and effectively implements laws, regulations and policy from higher authority.
- <u>Facility Life-Cycle Cost</u> – facilities are designed and constructed that have the lowest life cycle costs through technically superior design guidance that considers factors affecting first cost, operating costs, maintenance, sustainability, and disposal. User feedback at the Services level is an integral part of the process.
- <u>Cost of Criteria Development</u> – in-house staff and Services contractors prepare new criteria and update existing criteria to address mission, regulatory and level of quality requirements.
- <u>Responsiveness to Services</u> – guidance ensures facilities meet the operational requirements of the Services and enhances mission readiness and productivity.
- <u>Value to the Services Architect/Engineering/Construction (A/E/C) Contractors</u> – design guidance is uniform, easily applied, and consistent with standard industry practices.
- <u>Service Technical Expertise</u> – the Services maintain a core of technical expertise that allows them to implement design guidance, resolve issues, and continuously improve the criteria.
- <u>Speed of Development</u> – guidance is developed and updated quickly to meet changing requirements, and reflect new innovative technology and construction techniques.
- <u>Publication and Distribution Cost</u> –the Services use modern desktop computer publication software and electronic distribution of guidance on the Construction Criteria Base and the Internet.

The results of the Tri-Service Working Groups evaluation of the three options for implementing improvements in unified design guidance are summarized in the table below:

ANALYSIS OF KEY OBJECTIVES

Factor	**Tri-Service**	**One-Service**	**DoD**
Technical Quality	++	+	o
Facility Life-Cycle Cost	+	o	o
Cost of Criteria Development	o	o	-
Responsiveness to Services	++	+	-
Value to Services A/E/C Contractors	+	+	+
Service Technical Expertise	++	-	- -
Speed of Development	-	+	++
Publication and Distribution Cost	o	o	o

LEGEND ++ Very Positive + Positive o Neutral - Negative - - Very Negative

E. Conclusion

Centralizing design guidance under one of the Services consolidates the criteria function but is not truly cost-effective. The analysis indicates this option degrades the quality and responsiveness of the criteria consulting service to the users. Consolidating the function under the Secretary of Defense has the same disadvantages as consolidating under one of the Services and will increase costs and adds another layer of bureaucracy to the process.

The analysis indicates that the most cost effective method overall for implementing further improvements is through greater use of Tri-Service technical working groups operating as a formal documented process. Little additional administrative work will be required to implement this option. A detailed model of this process and a plan of action with milestones are presented in Appendix I.

The Tri-Service Working Group recommends greater use of Tri-Service groups as the overall best method to accelerate uniformity while still maintaining specialized Service expertise, the ability to provide rapid responses to critical issues and to address changing business environments, evolving acquisition strategies and contracting procedures.

6. Summary

Forty-three percent of the Services existing design criteria documents are unified. An additional four percent will be unified as a consequence of current initiatives. Many existing procedures, systems and tools are uniform among the Services.

There is potential for unifying the majority of the fifty-three percent of the Services design criteria documents that are not presently unified. There is also potential to build on and expand the existing uniformity of the Services guide specification system.

Greater use of Tri-Service working groups is the most effective system for making improvements to design guidance. Overall, it results in unified guidance that is technically superior; lowers facility life-cycle cost; is responsive to the Services missions; is valuable to the Services A/E/C contractors; and effectively maintains Service technical expertise. The Services have benefited from the research and analysis required to prepare this report and are actively moving toward greater uniformity in design guidance.

7. Submission

The Service Chiefs of Engineering, serving as the Steering Committee for development of a Unified Design Guidance Report to the Congressional Defense Committees, concur with the findings and recommendations of the Tri-Service Working Group and respectfully submit this report.

KISUK CHEUNG, P.E.	DR. GET MOY, P.E.	GARY M. ERICKSON, P.E.
Chief, Engineering and Construction Division Directorate of Military Programs U.S. Army Corps of Engineers	Chief Engineer Naval Facilities Engineering Command	Acting Deputy Civil Engineer DCS/Installations and Logistic HQ U.S. Air Force

Appendix I

TRI-SERVICE WORKING GROUP MODEL FOR UNIFIED DESIGN GUIDANCE

Objective

Develop Air Force, Army and Navy facilities design criteria using the coordinated, collective technical talent of all Services. Unify the main body of criteria documents (manuals, handbooks, publications, specifications, standard designs, etc.) for use by all Services. Streamline criteria and use commercial and national non-government standards whenever possible. Keep criteria current, and effectively implement laws, regulations, executive orders and DoD policies; introduce new and innovative technology; and define the level of quality required for facilities to support mission requirements throughout their life cycle.

Organization

1. Tri-Service Engineering Senior Executive Board

   a. Roles and Responsibilities:
      - Establish unified design guidance policy
      - Provide oversight of unified design guidance process
      - Resolve issues impeding unified design guidance
      - Act as resource/budget proponent for unified design guidance

   b. Members:
      - Air Force: Deputy Civil Engineer, DCS/Installations and Logistics, HQ U.S. Air Force
      - Army: Chief, Engineering and Construction Division, Directorate of Military Programs, U.S Army Corps of Engineers
      - Navy: Chief Engineer, Naval Facilities Engineering Command

   c. Chairperson: the members shall rotate the role of chairperson biannually.

2. Tri-Service Design Guidance Coordinating Panel

   a. Roles and Responsibilities:
      - Establish process and procedures to implement unified design guidance policy
      - Formulate and recommend unified design guidance policy to the Tri-Service Engineering Senior Executive Board
      - Formulate and recommend short term and standing Tri-Service Working Group charters and membership to the Tri-Service Engineering Senior Executive Board
      - Prepare and maintain prioritized unified design guidance requirements list
      - Prepare annual and future year unified design guidance action plan
      - Provide coordination and oversight of Tri-Service Working Groups
      - Arbitrate Service technical and procedural differences impeding unified design guidance. Prepare position papers for unresolved differences for final resolution and direction by the Tri-Service Engineering Senior Executive Board

   b. Members
      - Air Force: HQ USAF/ILEC, DCS/Installations and Logistics
      - Army: Chief, Technical Branch, Engineering and Construction Division, Directorate of Military Programs, U.S Army Corps of Engineers
      - Navy: Director, NAVFAC Criteria Office, Naval Facilities Engineering Command

   c. Chairperson: the members shall rotate the role of chairperson biannually.

3. Tri-Service Working Groups:

   a. Structure Working Groups as small as possible, but ensure Service technical and operational requirements are represented. Conduct business in a simple, effective and efficient manner. Use teleconferences, video-teleconferences and the electronic exchange of information and documents in lieu of face to face meetings whenever possible. Coordinate meetings with related professional meetings when possible.

b. Use existing Tri-Service Working Groups to the maximum extent possible to fulfill the unified design guidance roles and responsibilities of the groups listed below.

c. Roles and Responsibilities:
- Recommend unified design guidance to the Tri-Service Design Guidance Coordinating Panel
- Develop scopes of work and resource requirements
- Recommend Service Preparing Activity
- Ensure technical adequacy of assigned unified design guidance
- Coordinate with other Tri-Service Working Groups
- Identify technology and research needs

d. Discipline Tri-Service Working Groups
- Architectural
- Mechanical
- Structural
- Civil
- Geotechnical
- Electrical
- Environmental
- Fire Protection
- Interior Design
- Landscape Architecture
- Planning
- Security
- Value Engineering

e. Facility Category/Functional Tri-Service Working Groups
- Aviation
- Communication
- Waterfront
- Training
- Research, Development, Testing and Evaluation
- POL
- Ordnance
- Storage
- Medical
- Administrative
- Troop Housing
- Personnel Support
- Utilities
- Structures

- Family Housing
- Energy

f. Tri-Service Construction Guide Specification System Working Group

g. Members: Technical/subject matter experts from headquarters and field of each service, other federal agencies, and ad hoc industry representatives as appropriate.

h. Chairperson: members shall rotate the role of chairperson biannually.

4. Service Preparing Activities

a. Use existing Service criteria organizational structure to prepare and maintain the unified design guidance

b. Roles and Responsibilities:
- Act as the Tri-Service lead for assigned unified design guidance
- Coordinate Tri-Service review and approval of documents

Implementation Plan of Action and Milestones

The following plan of action is expected to achieve unification of all appropriate systems, tools and the remaining fifty-three percent of criteria documents to the maximum extent possible by September 2000:

1. Charter Tri-Service Engineering Senior Executive Board (03/98)

2. Charter Tri-Service Design Guidance Coordinating Panel (04/98)

3. Tri-Service Design Guidance Coordinating Panel develops process and procedures for unified design guidance using Working Groups (09/98):
   - Analyze the existing Air Force, Army Corps of Engineers, and Naval Facilities Engineering Command processes by

which technical guidance and criteria are planned and programmed, developed, reviewed and approved, applied, evaluated (feedback), maintained, updated, revised and either reissued or rescinded.

- Identify each Service difference (i.e. needs, responsibilities, technical requirements, business practices, document types and format, customers, publications and distribution) and examine various issues which must be overcome to effectively share criteria between the Services.
- Develop Tri-Service criteria preparation, coordination and review procedures at the working level emphasizing technical cooperation, cost efficiency and timely execution.

4. Amend charters of existing Tri-Service working groups to include roles and responsibilities for unified design guidance (06/98)

5. Charter new Tri-Service working groups necessary for unified design guidance (06/98)

6. Coordinate FY99 Service criteria preparation to ensure unified design guidance is prepared for high priority projects (09/98)

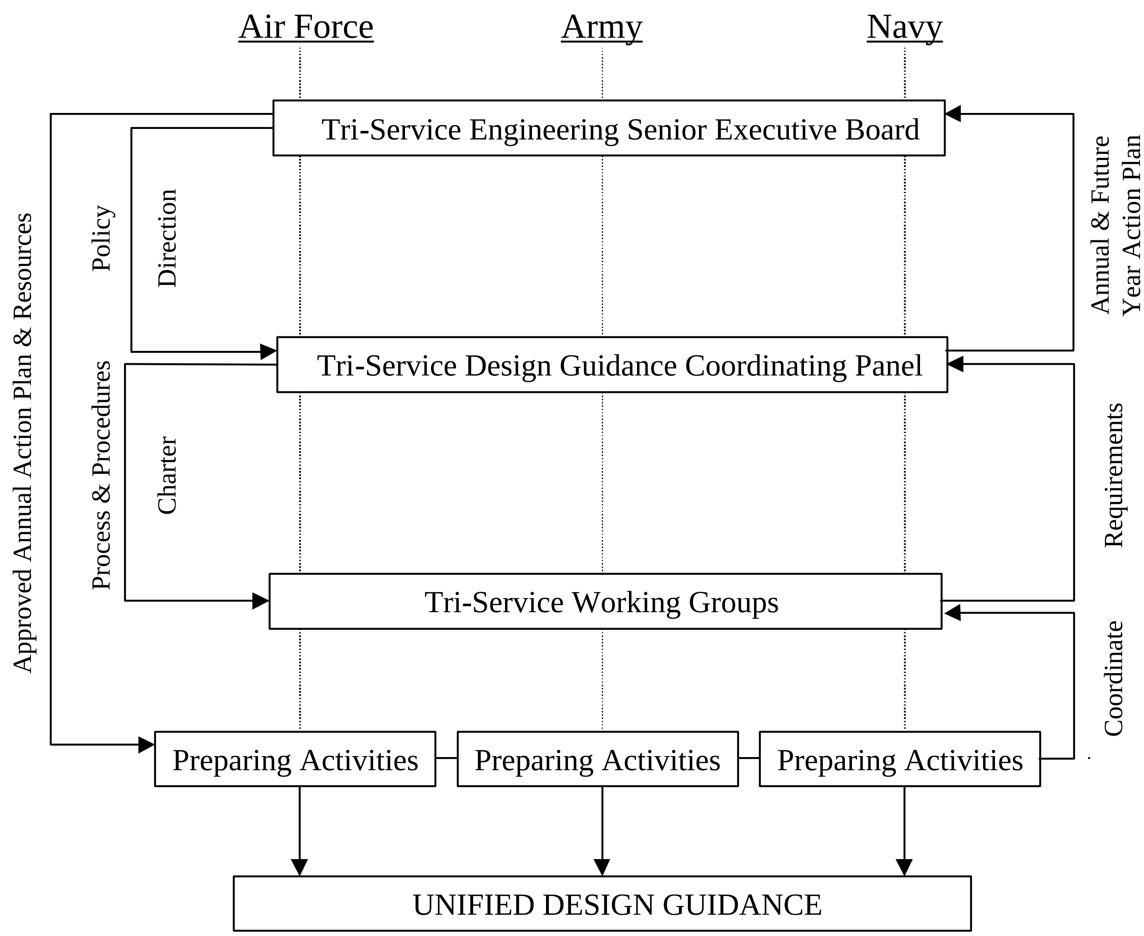
7. Tri-Service Working Groups provide recommended requirements list to Tri-Service Design Guidance Coordinating Panel (12/98)

8. Tri-Service Design Guidance Coordinating Panel prepare FY 2000 Annual Action Plan and initial Future Year Action Plan for Tri-Service Engineering Senior Executive Board (03/99)

9. Tri-Service Engineering Senior Executive Board approves and assign unified design guidance projects to Service Preparing Activities (06/99).

10. Preparing Activities begin work on FY2000 Unified Design Guidance Action Plan (10/99)

UNIFIED DESIGN GUIDANCE MODEL



Appendix II

SERVICE DESIGN GUIDANCE DOCUMENTS

Description	Unified Design Guidance: Tri	[1]Dual	[2]Dual	[3]Single	Total Unified	[4,5]Not Unified	Total
Aviation Operational Facilities	1	3	9	3	16	19	**35**
Communication Ops Facilities	1				1	1	2
Waterfront Operational Facilities	1			11	12	7	19
Other Operational Facilities			9	1	10	9	19
Training Facilities	1			3	4	6	10
Aviation Maintenance/Production						4	4
Other Maintenance/Production						9	9
POL Supply/Storage	1			2	3	10	13
Ammo Supply/Storage				12	12	1	13
Other Supply/Storage				2	2	2	4
Medical	1				1	2	3
Administrative			1		1	3	4
Troop Housing/Messing				1	1	11	12
Other Personnel Support/Service	3		2		5	14	19
Utilities	5	1	10	3	19	15	34
Real Estate & Ground Structures	1		6		7	1	8
Family Housing						2	2
Energy			1		1	1	2
Environmental						6	6
Discipline Criteria	7	2	17	4	30	26	56
Miscellaneous	9	6	9	5	29	58	87
TOTAL	31	12	64	47	154	207	361
% OF ALL DOCUMENTS (361)	9%	3%	18%	13%	43%	57%	100%

[1] Used by two Services with no need by other Service
[2] Used by two Services with possible use by other Service
[3] Unique to one Service with no need by other Services
[4] Includes fifteen documents (4.2% of total) that are in the process of being unified.
[5] Nearly all of the remaining documents have potential to be unified.

Areas Where Uniform Procedures, Systems and Criteria Are Already In Use

1. Design Criteria

Forty-three percent of the existing Service design criteria documents are “unified”. This figure includes documents that are Tri-Service, Dual-Service for which the other Service has no need, Dual-Service which have some potential for use by all the Services, and Single-Service unique for which the other Services have no need. An additional four percent of the Services criteria will be unified as a consequence of current initiatives. Appendix II summarizes the current status and baseline for achieving further standardization among the Services.

2. SPECSINTACT Guide Specifications System

SPECSINTACT is a state-of-the-art, automated specification processing system promulgated by the National Aeronautics and Space Administration (NASA) and is designed as a cost-effective means for producing construction project specifications from master guide specifications. The system incorporates various quality assurance (QA) features to reduce man-hours spent on verifying the accuracy of technical, testing, submittal, and execution requirements contained in specifications. USACE, NAVFAC, and NASA adopt it as the official means for producing and maintaining their guide specifications. This cooperative effort promotes uniformity and interchangeability of guide specifications among system users. SPECSINTACT is distributed on CCB and the Internet.

3. CADD/GIS

The Tri-Service CADD/GIS Technology Center (the Center) has been operational since 1993. The Center is an interservice vehicle to set standards, coordinate CADD/GIS related activities within the Services, promote system integration, provide evaluation of commercial off the shelf (COTS) technology, accomplish centralized procurement and provide information on the installation, training, operation and maintenance of CADD and GIS systems. The Services ensure efficient utilization of CADD/GIS throughout the life cycle of all projects -- from original planning and programming through design, construction, operation and maintenance.

Three groups are responsible for the oversight and management of the Center: 1) Tri-Service Executive Steering Group (flag officer or SES-level), 2) Executive Working Group (senior management), and 3) Field Technical Advisory Group FTAG (senior level field personnel).

Significant accomplishments of the Center include the development of a CADD Generic Details Library and three Draft Standards for A-E Deliverables, A/E/C CADD and GIS Spatial Data. Development of standards includes coordination with recognized industry professional and standards organizations. The Center is working with the National CADD Council in developing a National CADD Standard. The Center also works with the Federal Geographic Data Committee in developing guidelines and standards for geospatial information. Additional information is available on the Center Web Site at URL: tsc.wes.army.mil.

4. Cost Engineering

In October 1989, the Directors of Military Programs from the three DOD agencies (U.S. Corps of Engineers, Naval Facilities Engineering Command and U.S. Air Force Director of Engineering and Services) signed a Memorandum of Understanding (MOU), subject “Tri-Service Automated Cost Engineering System”. The intent of the MOU was to develop a single automated cost engineering platform for use by all DOD and contractor cost engineers for the preparation of all construction cost estimates.

The software developed is titled the Tri-Service Automated Cost Engineering System (TRACES). It consists of a core of software products (modules) and databases that program, develop, control, collect and maintain cost data of construction projects from inception through construction. These modules and databases include:

- Parametric Estimating System
- Micro-Computer Aided Cost Estimating System
- Life Cycle Cost System

- Historical Analysis Generator System
- Area Cost Factor Index
- DOD Military Facilities Unit Cost Guide
- Military Construction Cost Index
- Construction Unit Price Book
- Maintenance and Repair Database
- Historical Database

The Tri-Service Cost Engineering Steering Committee is responsible for the management of TRACES. All Services share equally in the development, review, implementation, and maintenance of these common software modules and databases.

5. Value Engineering

The DoD/Tri-Service Executive Steering Group for Value Engineering implements OMB Circular No. A-131 and value engineering related aspects of The Office of Federal Procurement Policy Act (41 U.S.C. 401 et seq.) and the National Defense Authorization Act for Fiscal Year 1996. It establishes and maintains cost-effective value engineering procedures and processes. It provides unified guidance for Service or contractor personnel to improve performance, reliability, quality, safety, and life cycle cost of facilities during planning, design and construction.

6. Design Tools

The Services use many of the same design tools and executable computer programs. Like other design guidance, they are available to the services and DoD contractors on the CCB. The tools and databases are used by the Services and their contractors to achieve lowest life-cycle costs; evaluate alternative building materials, systems and components; reduce energy consumption; review historical data; and develop accurate program cost estimates.

Some examples are:

- MotorMaster, Electric Motor Selection Software
- LTSM, Lighting Technology Screening Matrix & Lighting System Screening Tool
- PC-ECONPACK, Economic Analysis Program
- HAG, Historical Cost Analysis Generator
- SUCCESS, Estimating and Cost Management System

- TPES, Tri-Services Parametric Estimating System
- VEDIS, Value Engineering Database Information System

7. Standard Designs

The Services use various forms of standard designs as a means of design guidance for certain types of facilities. Standard facility designs may be full standard designs that include drawings and specifications sufficient in detail to serve as construction documents after modifications are made for site-specific requirements. They can also be definitive designs with drawings and information that delineate space allocations, functional layouts, and the basic configuration of a facility, and serve as guides in developing specific design and construction drawings. Design guides normally contain a combination of written and graphic material for a specific facility type, accompanied by several example designs. For example, the Services have adopted a standard design for new, reconfigurable, or expedient ranges developed under the Army/Marine Corps Range and Training Land Program. Other standard designs with Tri-Service applicability include petroleum fueling facilities, underground and above ground bulk fuel storage facilities, ammunition and explosives storage facilities and aviation lighting systems.

8. Criteria Distribution

The three Services use the Construction Criteria Base (CCB) to distribute criteria. CCB is a construction library on a set of compact discs published quarterly by the non-profit National Institute of Building Sciences. It is also accessible from an Internet site. It contains complete, unabridged, current electronic versions of the Services' criteria documents and executable programs. All completely indexed and easy to search, copy, print or read on-screen. CCB is available by subscription and already goes to over 4,000 offices around the world and is available to all DoD contractors. The Services also utilize Internet web pages to quickly and economically distribute design guidance, gather feedback and exchange information. Printed design guidance documents are available through the Department of Defense Single Stockpoint, the Defense Automated Printing Service.

9. Commercial Consensus Codes and Standards

All of the Services use commercial building products, materials, assemblies, systems and construction practices. They therefore also use commercial consensus codes and standards as the basis for design guidance and contract requirements, drawings and specifications. Unnecessary government unique requirements documents such as MIL-Specs and FED-Specs have, with few exceptions, been eliminated. ASTM, ASME, ANSI, ASHRAE, API, IEEE and many other non-government standards are used. With the development of true national codes by the major code bodies in the United States, further use of single building, mechanical, plumbing, fire, energy and electrical codes will be possible.

Service design guidance builds upon commercial codes and standards to provide for efficient facilities design and construction; provide expert guidance, create Service consistency in engineering and architectural applications, define military-unique requirements, set the level of quality required to improve functionality of the facility and lower life cycle costs; incorporate state-of-the-market technology and transition research and development; respond to rapidly changing requirements; and incorporate lessons learned and feedback. Technical experts from the Services participate with codes and standards organizations to ensure the needs of the Services are addressed as encouraged by the National Technology Transfer and Advancement Act of 1995.

10. Existing Service Working Groups

Working Group	Tri Service	Dual Service	Single Service
Airfield Lighting Systems Working Group	X		
Airfield Pavement Design Criteria Working Group	X		
Barrier Free Accessibility Working Group	X		
CADD/GIS Technology Center	X		
Cost Engineering Committee	X		
Engineering Weather Data Working Group	X		
Executive Steering Group for Value Engineering	X		
Facility Planning, Design, and Construction Working Group	X		
Federal Construction Metrication Council	X		
Federal Paint and Coatings Committee	X		
Fire Protection Engineering Working Group	X		
Fuel Facilities Engineering Panel	X		
Hardened Structures for Conventional Weapons Working Group	X		
Life Cycle Cost Working Group	X		
Physical Security Working Group	X		
Transportation Engineering Tech Leadership Working Group	X		
Underground Heat Distribution Systems Committee	X		
Specifications Systems Working Group		X	
Telecommunications Standards Working Group		X	
Energy Technology Leadership Working Group			X
Family Housing Working Group			X
Historic Preservation Working Group			X
Interior Design Working Group			X
Roofing Design and Construction Working Group			X
Standard Facilities Requirements Working Group			X
Sustainable Design Working Group			X
Vertical Structures Technology Leadership Working Group			X
Waterfront User's Working Group			X
TOTAL	17	2	9

Appendix IV

Report of the Tri-Service Working Group Subcommittee For Unified Construction Guide Specifications

UNIFIED CONSTRUCTION GUIDE SPECIFICATIONS REPORT TO THE TRI-SERVICE WORKING GROUP ON UNIFIED DESIGN GUIDANCE

6 January 1998

1. EXECUTIVE SUMMARY. In response to Congressional direction requiring DoD and the Services to report on the status, possibilities, and most cost-effective means for obtaining unified design guidance for military facilities, a Tri-Service subcommittee was established to provide information regarding construction guide specifications which are part of the design guidance system. The subcommittee found a high degree of uniformity in the guide specifications used by the Services and determined that there are opportunities for continuing efforts to maintain and promote that uniformity. The subcommittee determined that the most cost-effective means for implementing improvements to the development of unified construction guide specifications is through greater use of Tri-Service groups.

2. INTRODUCTION. This report is provided by the Tri-Service Working Group (TWG) Subcommittee for Unified Construction Guide Specifications in accordance with direction provided by the TWG. The Subcommittee task was to provide input on guide specifications that could be used in preparation of a response to House Conference Report 105-247, dated 9 September 1997, on Unified Design Guidance. In formulating this report, the Subcommittee reviewed a 1995 report on joint-agency construction guide specifications which identified many similarities in specification practices and recommended areas where additional uniformity could be accomplished. Since 1995, many of these recommendations have been implemented or simply ceased to be issues. In addition, the Subcommittee also reviewed current practices of the three Services and evaluated possible methods for further promotion of unified construction guide specifications.

3. ISSUES. The three issues raised in the House Conference Report are identified below, followed by guide specification-related information pertaining to each issue.

a. Areas where uniform procedures, systems, and/or criteria are already in use.

(1) The nationally-recognized formats and recommendations for construction specifications established by the Construction Specifications Institute (CSI) have proven beneficial to the construction industry as a whole and are generally used by the Services in

Page 1 of 4

establishing uniformity and common practices and methods within construction specifications.

(2) SPECSINTACT, a standardized software program for producing construction specifications, is jointly used by USACE, NAVFAC, USAF, and NASA and requires a high degree of uniformity of specification databases used within the system. SPECSINTACT is also used within the A-E community for non-government work, as well as for other Federal, state, and local work.

(3) Many industry standards, codes, test methods, and other publications developed by various segments of the construction industry--e.g., the American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), American Society of Mechanical Engineers (ASME)--are used in the guide specifications to cite requirements for products, systems, procedures, and standard tests for various construction elements. These reference publications are used by the Services and, in many cases, are virtually the only documents available for specifying construction contract requirements.

(4) The Single Master Reference List (SMRL) provides source, title, date, and other information regarding publications referenced in USACE, NAVFAC, and NASA guide specifications. The SMRL serves as a SPECSINTACT tool to ensure uniformity of references in guide specifications that are prepared for use in SPECSINTACT.

(5) The Services (and many other government and private organizations) have adopted the Construction Criteria Base (CCB) Information System as a unified means for distributing guide specifications and other criteria documents to users. The system is maintained by the National Institute of Building Sciences (NIBS) under the direction of the CCB Coordinating Committee. The Services have representatives on this committee to establish common policy for the CCB System.

(6) The Internet is also used by the Services to publish their guide specifications, and interagency links have been established to ensure all agency guide specifications are essentially available in one location. This permits guide specification users to pick and choose the most appropriate guides for their projects from one source.

(7) A joint-agency working group on submittals has been established to develop common policy, terminology, and formatting for the submittals that are required of the construction contractor. Agreements reached within this group will be reflected in the guide specifications of the Services and NASA.

(8) A charter for a Joint-Service working group on mechanical and electrical specifications has been drafted, and when fully operational, this group will work toward improved uniformity in mechanical and electrical systems requirements and the methods in which they are specified.

b. Other possible areas where it may be practical to create more uniformity.

(1) The use of Tri-Service technical coordination groups holds the most potential to reduce costs, assure that criteria are current, and provide updated guide specifications that meet the needs of customers in a timely manner. To ensure maximum efficiencies and reduced implementation costs for this process, such coordination groups should make maximum use of facsimile, telephone, and e-mail communications for conducting business.

(2) Tri-Service groups would have the most immediate impact in unifying guide specification technical requirements for products. Industry and Service-specific requirements for most products are currently very similar and, therefore, are good candidates for short-term unification.

(3) While other similarities exist in Service guide specifications for requirements such as contractor submittals, quality control, delivery, storage, and handling of materials, warranties, and construction execution, these requirements typically reflect Service-unique business practices and lessons learned and will require more of a long-term effort to unify. However, some unification of these items could be obtained by sharing lessons learned during design and construction and through the efforts of the existing joint-agency working group on submittals.

(4) A mechanism to share user feedback among the Services could be established to help unify the differences cited above and to resolve common problems that may exist. Each Service receives feedback on its guide specifications, and this information could be posted on the Internet for use during specification maintenance and updating. USACE currently publishes its feedback in a periodical publication which is uploaded to a dedicated web site.

(5) To further facilitate unification of guide specifications requirements and improve operational performance and database management in SPECSINTACT, a Joint-Service Guidance Document could be developed and implemented by the TWG. This document could contain instructions for preparing guide specifications to ensure uniformity of the guide specification databases.

(6) Where practical, a single coordination of requirements with industry could be used instead of independent coordinations by each Service. This would conserve resources and provide a unified interface with industry.

(7) Finally, NAVFAC has fielded a DoD-promoted, automated standard procurement system for construction contracts called Procurement Desktop Defense (PD2). This system is expected to be fielded in USACE by mid-1998 and may eventually be linked to SPECSINTACT.

c. The most cost-effective system for implementing improvements either through a greater use of Tri-Service groups, centralized development and management under one of the Services with design and construction authorities, or centralizing the development and management of design guidance under the Secretary of Defense.

(1) The most cost-effective system for implementing improvements would be greater use of Tri-Service groups. This would permit operation under organizations now in place, would permit the sharing of resources, would permit rapid dissemination of criteria, would eliminate the need for additional layers of authority or bureaucracy, would draw upon the combined corporate knowledge of the three Services, and would maximize the use of technical experts actually involved in day-to-day problem solving during design and construction.

(2) The three Services are currently a powerful force in bringing the design practices of the services closer together and in working toward a unified construction guide specification system. Ultimately, major expansion of this established relationship is the best approach to arrive at unified guidance and still allow the flexibility each Service needs to be responsive to its own missions and customer requirements.

4. SUBMISSION. The members of the Unified Construction Guide Specifications Subcommittee to the TWG respectfully submit this report of our findings. We are pleased to have been able to support the TWG in the preparation of its report to Congress. We see the many current and future cooperative efforts toward unified construction guide specifications as a good and logical course of action and look forward to continued participation in this regard.

Original Signed By:

/s/	/s/	/s/
JOE MCCARTY, P.E. USACE	CARL KERSTEN, R.A. NAVFAC	LARRY SPANGLER, R.A. USAF
/s/	/s/	/s/
JIM QUINN, P.E. USACE	ED GALLAHER, P.E. NAVFAC	RICK DAHNKE, C.C.S. USACE

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Figure FF/OS-5
Sample Outline Specification Section.

SECTION 07500
MEMBRANE ROOFING

A. SYSTEM DESCRIPTION
1. Removal of existing built-up roofing and insulation.
2. New UL Class A, 4-ply built-up roof with rigid insulation.
3. Expansion joints where indicated.
4. Application method to achieve FM I-60 wind rating.

B. WARRANTY
Two-year warranty of materials and workmanship for watertightness, extended to include flashings and membrane.

C. COMPONENTS
1. Acceptable Systems:
   a. System ABC, 123 Company.
   b. Easy-On System, Sunny Daze Co., Inc.
   c. Me-2, C-U Tomorrow, Ltd.
2. Insulation:
   a. Two 38 mm (1-1/2 inch) layers of rigid phenolic foam insulation board for R-value of 24.
   b. 6 mm (1/4 inch) per 300 mm (12 inches) tapered perlite board, suitable to ensure proper drainage.
   c. Approved by FM for direct application over metal deck.
3. Manufacturer's standard single-ply base flashing.
4. Aggregate: Dry, clean river run gravel, ASTM D1863, free from dust and fines.
5. Expansion Joints:
   a. Preformed metal type, curb mounted.
   b. Acceptable products:
      (1) RU4-Real, Spread Eagle.
      (2) Cover-up, Robert Rules Corporation.
   c. Expansion joint locations:
      (1) Changes in roof deck materials or changes in direction of roof decking.
      (2) At building expansion joints.
      (3) Unbroken lengths and widths of roof exceeding 60 meters (200 feet).

D. PREPARATION
1. Removal of existing roofing and insulation system.
2. Removal of existing roof drain sumps, rotted wood blocking, rusted metal decking, and installation of new replacement materials.
3. Removal of debris from roof area and preparation of roof deck to receive new roofing system.

CEMP-ET 2 April 1998

COMMENTS
Specifications Engineering Draft Regulation
Dated 31 March 1998
Combining CW & MP Specifications Engineering Policy

1. General:

a. We have major concerns with the basic approach and content of this draft ER. It should be rewritten in accordance with the following comments and resubmitted for review.

b. ER's are written policy explaining "what is required" by HQUSACE not "how to" procedures. The offices for which an ER is intended are required to develop "how to" procedures complying with requirements contained in an ER. All "how to" procedures and requirements contained in this draft regulation should be removed.

c. In Military Programs the specification proponents are responsible for identifying criteria and guidance needs, setting priorities for criteria development and reviewing and approving individual guide specifications. The specification proponents obtain field input in performing these functions; however, the proponent is responsible and remains actively involved throughout the process. In the draft ER many of the proponents responsibilities have been delegated to the Corps Specification Steering Committee (CSSC), the "technical expert" and the "specification engineers."

d. Change title of the ER to "Preparation of Project Specifications." This is more in keeping with the appropriate intent and content of the ER.

e. In many districts the "specifications engineer" is primarily involved in coordinating functions and insuring that the "front end" meets the needs of the designers and assembling the technical sections prepared by the designers. They certainly do not have all of the responsibilities listed in the draft ER. The term and duties of the "specifications engineer" should be removed from this ER.

2. Reference Purpose:

The purpose of this ER should be to prescribe policy and requirements for the preparation of project specifications, not prescribing specifications engineering policy and procedures. Recommend removal of the portion of this paragraph dealing with the establishment of the CoE specifications steering committee (CSSC) and procedures for updating CEGS. The CSSC is not recommended nor required for development or updating to those CEGS that are primarily used by Military Programs Directorate. If Civil Works requires such a body, it should be separate from this ER.

3. Reference Definitions:

a. Recommend deleting references to specifications engineer, designer, guide specification technical expert, notice program coordinator and corps specifications steering committee.

b. Remove reference to preliminary bid schedule. This is not part of the guide or project specifications. The preliminary bid schedule is a project specific requirement and should not be part of this specifications ER.

c. Outline specifications are required for MILCON projects and are recommended for Parametric Design and design charette processes. The outline specifications identifies specific structural/architectural/mechanical/electrical systems, major salient features and what applicable USACE guide specifications will be used. This information is required to adequately formulate satisfactory cost estimates.

d. Commercial guide specifications should also be included as it presently is in ER 1110-345-700. CEGS does not cover all aspects of construction and private industry specifications are sometimes used with precautions that they must be nonproprietary and comply the FAR's and other regulatory and legal requirements.

e. The HQUSACE proponent, in Military Programs, is responsible for the technical content of the guide specifications and the program to develop new guide specifications and keep The existing guide specifications updated. The proponent represents the technical disciplines that prepare the project specifications, not the specification engineers. The use of this term must be revised to reflect the actual responsibilities or delete it from the ER in favor of defining some general HQ responsibilities and allowing both CW and MP to implement these responsibilities differently.

f. Use MP wording, with minor changes, for CCB paragraph. Although longer, it provides more information, especially on what the CCB contains.

4. Reference paragraph 5:

Specifications Engineering During Project Phases: Remove this paragraph. There is no need to explain in detail the influence and responsibilities of the specification engineering. Each office in the Corps has the responsibility to develop these positions the best way to serve their mission. For military projects, many of the functions listed for the "Specification Engineer" are performed by the designers. If not deleted, this paragraph would require major changes to be applicable to MP.

5. Reference paragraph 6:

Training: This ER should not address training requirements for those preparing project specifications.

6. Reference paragraph 7:

Completely revise paragraph to clearly indicate HQUSACE Proponent responsibilities in accordance with these comments or delete.

7. Reference paragraph 8:

CSSC: Delete this paragraph per previous comments.

8. Reference paragraph 9. CEGS:

a. Remove all references to CSSC. Delete paragraphs addressing Management and

Distribution, Maintenance and Funding. This information should not be part of this ER.

b. The purpose of CEGS is also to provide a set of master specifications that implement and are consistent with Federal Regulations and laws, Executive Orders and Army policy such as energy and water conservation, green buildings initiatives and reductions in emission of greenhouse gases.

9. Reference paragraph 10:

Outline Specifications: Include requirements presently contained in Military Programs version for ER on specifications.

10. Reference paragraph 11.

a. General Requirements: Remove references to specifications engineer.

b. Remove para 11b. This information relates to "how to" tasks. The district is required to determine "how to" relationships among designers and those responsible to project specifications together.

c. Revise para 11c to reflect the writing currently contained in Military Programs ER on Specifications.

d. Insert a paragraph that addresses Deviations from Guide Specifications. It is not intended to give any specification writer authority to deviate from guide specifications. Deviations must come from the chief of the engineering function. The chief of the engineering function can, given appropriate justification material and information, determine if a deviation is necessary and authorized. The chief of the engineering function is responsible when deviating from the guide specifications, not the individual technical designer. Much of the information contained in the MP line # 434 would be very appropriate.

e. Much of the material from MP line #551, item d, should be added. It is appropriate information for this ER.

f. Brand names and proprietary items. Use the MP line # 627 paragraph except include sentence on specifying the salient characteristics for determining equality.

g. Contractors Option. Add requirement that the chief of the engineering function approve the addition of options, not included in the guide specification, to a project specification.

11. Reference paragraph 12.

Notice Program: Remove all "how to" requirements from this paragraph. There is no need to explain how the notice program is be accomplished. This is an ER on project specifications. Delete references to funding from paragraph 12a (last sentence) but retain the remaining portions. Delete paragraphs 12b and 12c.

12. Insert paragraph 6 "Modified Versions of USACE Guide Specifications" from ER 1110-345-700. This paragraph should still be guidance to the field when preparing project specifications.

13. Add a paragraph on the purpose and use of the short form guide specifications.

14. Add a paragraph including much of the material from MP line # 468.

CEMVK-ED-DE

26 March 1998

MEMORANDUM FOR Corps Specifications Steering Committee (CSSC)

SUBJECT: Notice Program for Combined CEGS/CWGS Database

1. This is an Information Paper.

2. PURPOSE: To provide information regarding current operation of the CWGS Notice Progam, effect on CEMVK-ED-DE if the Notice Program were relocated from CEMVK, and possible method of operation if the combined CWGS/CEGS Notice Program was operated from CEMVK-ED-DE.

3. RECOMMENDED USE: This Information Paper is intended for use, in conjunction with an information paper from CEHNC, for the purpose of assisting the CSSC in formulating a recommendation to HQUSACE on the location and operation of the combined CWGS/CEGS Notice Program.

4. INFORMATION: The attached enclosure Notice Program for Combined CEGS/CWGS Database" dated 26 March 1998, provides the information needed for CSSC use.

Thomas R. Shaw, Jr., P.E.
Civil Works Notice Program Manager

Encl

26 March 1998

NOTICE PROGRAM
FOR
COMBINED CEGS/CWGS DATABASE

1. BACKGROUND: As requested at the January 1998 Corps Specifications Steering Committee (CSSC) meeting, CEMVK was tasked with providing an information paper presenting a proposal to consolidate the Notice Programs for the Civil Works Guide Specifications (CWGS) and the Corps of Engineers Guide Specifications (CEGS) for Military Construction. The concept of consolidation has been presented to the (CSSC) and to the Civil Works and Military Directorates at Headquarters. This consolidation effort is considered to be an effective and efficient means of eliminating a redundancy that currently exists in the two directorates and is essential to having one Corps of Engineers specifications system. The programs in their current state are maintained separately with CEHNC performing the Notice Program function for the CEGS and CEMVK maintaining the Notice changes for the CWGS. The preparation of this paper is in response to the four tasks identified by the CSSC for the CW Notice Program Manager and are as follows:

   - Identify and describe the Civil Works Notice Program as it currently operates
   - Estimate the impact on CEMVK if the CW Notice Program activities are moved to another location.
   - Prepare a plan and estimate for the effort required to perform all Notice Program functions at CEMVK.
   - Make recommendations regarding what is the "Best" way to manage a combined Notice Program.

1. CURRENT CWGS NOTICE PROGRAM OPERATION: The primary purpose of the Notice Program is to update and maintain the CWGS database on a continual basis to reflect changes in technology, standards, and referenced publications. This function is performed and coordinated through the Specifications and Quality Control Section at CEMVK. Personnel in this Section perform this CWGS maintenance and then we turn around and use most, if not all, of these same guide specifications in developing project construction specifications. We have a vested interest in ensuring that these guide specifications are of good quality and are completely compatible with the SPECSINTACT software. The program is accomplished through continual review of the guide specifications, references cited and technical issues that arise. Notices may be required for technical, policy, or administrative reasons and can be initiated through various channels. For example, the CSSC may request that a Notice be done for a Special reason, the HQ proponent may request a Notice from a technical or policy standpoint, or the Technical Representative may request a Notice for a technical change within the guide specification. The Notice process is relatively straightforward once the need for a Notice has been identified. The first step is for the CEMVK Specifications Technician to perform a review on the references cited noting the revision or issue date. After the references have been updated, the Technician then considers any requested change and it's affect on the guide specification. The Technician will then make the editorial changes

ensuring that they are made in compliance with the Construction Specifications Institute three-part section format and applicable Corps specifications guidance. The edited guide specification (with additions shown as underlines and deletions as overstrikes) is then transmitted to the Technical Representative for review and comment. The Technical Representative then reviews the proposed changes and may in this process see the need for additional changes. If so then, these changes are identified and the entire package is returned to the Technician for incorporation of the changes. The Specs Technician makes any required changes and the guide specification is then transmitted to the HQ Proponent for approval. If additional changes are requested, they are made and re-transmitted to the HQ Proponent (if required) and the Notice to this guide specification can now be issued. This is done by transmitting the approved notice to CEHNC for posting on the TECHINFO website and eventually onto NIBS for inclusion on the next release of the Construction Criteria Base (CCB). The Notice Program Coordinator through all phases of the program provides administrative oversight and coordination. The level of effort required for the Notice Program includes one technician working at about 80% of full time, the Notice Program Coordinator working at about 25% of full time, and a limited amount of technical representative review time. The majority of the CWGS Technical Representatives are located at CEMVK and as regular users of the guide specifications have a vested interest in the maintenance of high quality master specifications.

2. EFFECT ON CEMVK IF NOTICE PROGRAM MOVED TO ANOTHER LOCATION: The Notice Program is a crucial part of the Civil Works Guidance Program. The Vicksburg District is relying on this funding in a time in which project funds are being significantly reduced. Relocation of this program would have a direct impact on approximately 1.3 FTE and would require reassignment or possible dismissal of the affected employees. Since the majority of the CWGS Technical Representatives are located at CEMVK and because almost all of this work is done on a voluntary basis, CEMVK basically does a trade off of the voluntary labor effort for the gains in technical expertise through the maintenance of the guide specifications.

3. PLAN FOR CEMVK PERFORMING ALL ACTIVITIES ASSOCIATED WITH CURRENT CW AND MP NOTICE PROGRAMS: Although CEMVK could pickup the necessary resources to take over the entire Guidance Program performed by CEHNC, it would not be realistic to duplicate the infrastructure and people in place for maintenance of the SMRL and the TECHINFO website. Therefore, this is not considered to be an improvement in efficiency or cost effectiveness for the purpose of this paper.

4. RECOMMENDATIONS REGARDING LOCATION OF NOTICE PROGRAM: Both Notice Programs (MP and CW) perform similar and extremely important functions. In addition to handling the Notice Program for MP, CEHNC also performs many other important functions related to criteria update. These include maintaining the multi-agency Single Master Reference List (SMRL), maintenance of the TECHINFO website, and

providing the quarterly updates for the CCB Database which includes both the CEGS and the CWGS. CEMVK proposes merging only that effort directly related to producing the notices for the combined guide specification program. CEHNC would continue maintaining the SMRL, the TECHINFO website and coordinating the Notices for MP. Essentially, the actual maintenance of the guide specifications would be accomplished at CEMVK. CEMVK is in a unique situation with regards to maintaining the guide specifications because we prepare project specifications for construction and actually use the very master specifications we maintain. CEHNC does not do this as a normal function. CEHNC would be the POC for the CEGS Notice Program and provide administrative oversight and control of the Program through the Notice Program Manager. The day-to-day activities of guide specification maintenance would be performed at CEMVK through the activities of the Notice Program Coordinator.

5. COMBINED NOTICE PROGRAM OPERATION: The goal of consolidating the two Notice Programs into one is to become more efficient through the elimination of any redundancies found in the two systems, and still meet the different needs of the directorates, customers, and staffs. For the purposes of the remainder of this document, CEGS will be describe the combined guide specifications database. This can be accomplished by implementing the following:

a. Each directorate will manage and maintain responsibility for it's own documents, exercising full control over program composition, funding, assignment of work, designation of HQ Proponents and Technical Representatives, and other decisions relating to the content and quality of that directorates documents. CEHNC will be responsible for the management of the Combined Notice Program and CEMVK will be responsible for the actual maintenance of the guide specifications. Responsibility for funding both the Notice Program Manager and the Notice Program Coordinator will be accomplished through the CSSC.

b. Development and review of documents is the responsibility of the "owner" directorate and the implementation of this responsibility is through the CSSC. Guide specification formatting will be in accordance with the current edition of the guidance document for preparation of guide specifications as found on TECHINFO and CCB. The guidance document is the joint responsibility of both directorates through the CSSC. Quality assurance review of selected documents to assure compliance with the guidance document and to verify compatibility with SPECSINTACT will be performed by CEHNC.

c. Scheduling of all Notices and the coordination of Notices for MP documents will be performed by CEHNC. Coordination of Notices for Civil Works documents will be performed by CEMVK. The actual incorporation of changes provided by Technical Representatives and HQ Proponents, updating of reference publications in accordance with information available in the SMRL, text coding in SPECSINTACT, obtaining approvals, maintenance of tracking logs, and quality control efforts are the responsibility of CEMVK. All new and revised guide specifications would be submitted to CEHNC for format review and then be sent to CEMVK for entry into the CEGS database. Normal time for preparation and completion of Notices will be 4-6 weeks.

d. CEHNC will perform all operations necessary to maintain indexes of CEGS, to place CEGS on TECHINFO and CCB, and to maintain associated files and databases. Documents will be placed on TECHINFO at regular intervals following their approval and will be placed on CCB in the quarter in which they are approved. Indexes, files and databases will be completed as the work progresses. Also, CEHNC will maintain the list of CEGS HQ Proponents and Technical Representatives on the TECHINFO website.

6.

e. Maintenance of Library and SMRL. CEHNC will maintain the SMRL by listing all reference publications cited in CEGS (as well as the guide specifications for Navy and NASA) and communicating with standards producing organizations to assure that the current issue of referenced publications are identified. The current issue of each reference publication cited in CEGS will be maintained at CEMVK.

6. ESTIMATED COSTS FOR CEGS NOTICE PROGRAM: The estimated total cost to execute the Notice Program for CEGS, excluding maintenance of the SMRL and TECHINFO activities, would be $360,000 per year and is based on the following:

a. Entering, including any necessary adjustments, approximately ten new and superceding CEGS into the system each year.

b. Elimination of separate CEAGS database and maintenance of these specifications through the use of Tailoring Options in SPECSINTACT.

c. Preparing, coordinating, and entering approximately one notice per CEGS guide specification (average of four pages per Notice) into the system each year.

d. Delivery of all guide specifications to CEHNC for placement of documents on TECHNINFO and CCB.

e. Maintenance of the publications library at CEMVK, excluding those references found on the CCB.

f. Equipment, supplies and other incidental costs associated with the effort.

Amendments in SPECSINTACT

U.S. Army Corps of Engineers
Sacramento District

Steven P. Freitas

Continuous Improvement

SPECSINTACT With SGML

Slow o Fast
Unreliable o Reliable
Unfriendly o Friendly
No Graphics o 32 BIT Application
No Amendments o ?

Amendments

Many Ways to Do Business

- No Specific Guidance Exists
  - < Replace Changed Pages
  - < Replace Entire Sections
  - < Provide Narrative Descriptions
- Must be a Flexible Process

SPECSINTACT With SGML

Standard Automated Specification System

- # **Mandated to Standardize Specifications**
- # **Make Enhancements for Amendments**
- # **Standardize the Amendment Processes**
- # **Must be Flexible Process**

Current Text Marking Problems

Difficulties and Issues

- Executing Redlines
- Marking Text Changes
  - < ~ In Margins
  - < Tags in Text
    - \1\ ... /1/
  - < Redlines
    - <DEL> and <ADD>
- Subpart Numbering

Current Pagination Problems

Difficulties and Issues

- Controlling Page Breaks
- Marking Page Changes
  - < Additional Footer
  - < Additional Page(s)
  - < Page Ranges

Current File Management Problems

Difficulties and Issues

- Tracking Amendment Files
  - < Duplicate Section Names
  - < Multiple Page Files

“ORIGINAL” Contract Document

What is it?

- “ORI GINAL” Document
  - < The One Last Changed to Produce a Copy
- All Amendments are “ORIGINAL”D ocuments
- Re-advertise Amended Jobs as New Jobs
  - < All Amendments Included as New

Proposed Amendment Process

SPECSINTACT With SGML Module

- Archive Job as Read Only
- Assign Amendment Number
- Create Enclosure Outline
  - < Select Section(s) and page(s)
- WYSIWYG Edit with Redlines

Proposed Amendment Process

Module Print Options

- Single line Footer
- Alphanumeric Pagination
- Print Redlines
- Select All or Some Enclosures

Amendments in SPECSINTACT

Conclusion

- Questions?

MECHANICALLY STABILIZED EARTH (MSE) WALLS AND SLOPES

GENERAL

A proposal was submitted to Headquarters, thru MVD, for the St. Paul District to prepare guide specifications for: (1) Segmental Concrete Retaining Walls; and (2) Reinforced Steepened Slopes.

Segmental Concrete Retaining Walls consist of dry stacked concrete units that may or may not contain soil reinforcement. For walls more than about 3 feet in height, these walls generally require reinforcement connecting the blocks to the backfill. In the St. Paul District, we have used geogrid as a reinforcement in order to construct walls up to 20 feet in height.

Reinforced Steepened Slopes consist of steepening a slope face using a soil reinforcement in order to fit limited real estate sites. Slopes can be steepened to to nearly 70 degrees from horizontal.

BENEFITS

The St. Paul District has designed and constructed a number of these systems and has realized significant cost savings:

MSE Walls: $17 to $20/sf of wall face vs. $50/sf for cast in place walls.

Through the use of these systems on nearly a dozen projects prepared by our District, we have developed specifying and bidding methodologies that we follow to insure we get the product we want. A paper discussing this methodology won the North American Geosynthetics Society Technical Award of Excellence at the Geosynthetics '97 conference.

STATUS

MVD forwarded the St. Paul Districts proposal to HQUSACE with a recommendation that an ETL be prepared in conjunction with the guide specs. The St. Paul District has the expertise and experience necessary to perform this work and also has a close working relationship with Mr. Ryan Berg, a leader in the field of geosynthetic engineering.

If this work is funded by HQUSACE, St. Paul proposes to:

- Prepare an ETL to discuss the design procedures, bidding and specifying alternatives, applications where the use of these systems is not recommended, and current state of research regarding these systems.
- Prepare guide specifications that will govern all applications of geosynthetic reinforced walls and slopes rather than the project specific specifications provided with the MSE proposal.
- Have all work peer reviewed by COE personnel as well as leaders in the field of geosynthetic engineering. The peer review team would be involved from the beginning of the project to provide input at all stages.

SPECIFYING AND BIDDING SEGMENTAL CONCRETE FACED MSE WALLS ON U.S. ARMY CORPS OF ENGINEERS, ST. PAUL DISTRICT PROJECTS

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ABSTRACT

The U.S. Army Corps of Engineers St. Paul District has designed and constructed several geosynthetic reinforced mechanically stabilized earth segmental retaining wall (MSE SRW) systems in recent years. Most Corps of Engineers projects are constructed in challenging riveine environments. Specfying and bidding geosynthetic reinforced MSE SRW systems can be difficult, due to the limitations of federal procurement regulations, which do not allow for preapproved geosynthetic reinforced MSE SRW systems. Several unique approaches are now used to specify and bid geosynthetic reinforced MSE SRW systems based upon experiences and lessons learned from previous projects. A variety of approaches are used to address issues such as: foreseeable construction difficulties; design presentation; material specifications; bid items; allowable modifications to the presented design; design and shop drawing submittal requirements; and quantity determinations.

Specification and bidding of geosynthetic reinforced MSE SRW systems are discussed through the presentation of several case histories; each of which used a somewhat different specification and bidding approach. The discussions include kev features of each project, the key design issues which led to the specification and bidding approach used, and lessons learned from each project. Data is presented which summarizes unit prices for various bid items, based on the specification and bidding approach utilized on each project. Key items to address in the design, specification, and bidding of geosynthetic reinforced MSE SRW systems are summarized. This paper is directed towards both government and private designers of geosynthetic reinforced MSE SRW systems.

INTRODUCTION

The St. Paul District of the U.S. Army Corps of Engineers (COE) has incorporated the use of geosynthetic reinforced mechanically stabilized earth segmental retaining wall (MSE SRW) systems into civil works flood control and operation and maintenance projects. Since federal procurement regulations do not allow for preapproval of MSE SRW systems, several methods of specifying and bidding MSE SRW systems have been developed by the St. Paul District. These method; use specifications and bid items which provide fair and open competition among potential bidders. Other information provided in the contract documents varies from project to project, depending on the geotechnical nature of the site.

This paper presents a historical perspective on the use of traditional wall systems and factors leading to acceptance of MSE SRW systems for COE projects. The methods used to specify and bid MSE SRW systems are discussed.The use of these methods is illustrated in four case histories. Lessons learned from the specification and bidding of MSE SRW svstems and the use and construction of MSE SRW svstems are discussed. Comparative cost information for the case histories is documented and a comparative summary of the methods is presented.

HISTORICAL PERSPECTIVES

Use of Traditional Wall Svstems. For nearly 100 years the St. Paul District of the U.S. Army Corps of Engineers has designed and constructed various types of wall systems as major components of civil works flood control projects. The traditional wall systems include: concrete cantileverwallIs; I-walls; cantilevered sheetpile walls; and anchored sheet walls. These systems have been successfully constructed and perform we11. However, they can be costly and may not provide an aesthetically pleasing project feature. A comparative summary of estimated costs of various traditional wall systems vs. MSE SRW systems is presented in the 1iterature.

The majority of COE projects are designed for a 100- to 200-year project life. The project features are typically constructed in a riverine or reservoir environment. As such, additional design criteria and concerns need to be satisfied and addressed. Recently revised COE design criteria (USACE, 1989 and 1990) for retaining walls requires the application of strength mobilization factors (SMFs) to soil parameters. The use of SMFs typically results in longer footing width requirements for a given height of traditional concrete catilever wall than in the past Frost considerations and bearing capacity requirements also typically require more stringent embedment depths for wall system foundations.

Federal cost sharing agreements for most projects now require local sponsors to share 25 percent of the design and construction costs associated with standard flood control features and 50 percent of the design and construction costs associated with recreation features. As a result, the local sponsors have a vested interest in both the aesthetic appearance and the final costs of project features. Sustainability has become a major factor in the design and construction of COE projects.

Use of MSE Wall Systems. In the mid to late 1980s, MSE wall vendors began presenting the benefits of MSE wall systems to the St. Paul District. However. the design standards used by the COE did not allow for immediate acceptance of these wall systems. Technical concerns included product performance and longevity. Non-technical concerns included sole source specifying and bidding of the MSE wall systems.

The late 1980s and early 1990s saw the introduction of MSE wall systems with geosynthetic reinforced backfill and concrete segmental retaining wall (SRW) units in private works. Since detailed information was not available regarding the performance of geosynthetic reinforcement and segmental block materials over time, Especially in a riverine or reservoir environment, the MSE SRW systems were not considered for use by the COE. Technical factors considered to be potential problems included connection strength and performance, creep of the geogrid materials, freeze-thaw characteristics of the segmental block materials (especialIy when the toe is permanently submerged), damage to the block units from debris in the river during high flows, and movement of fines from behind a wall during rising and falling river stages. (Meyers and Schwanz, 1993).

The use of MSE SRW systems in private work by others accelerated rapidly. Many vendors can supply a variety of types of geosynthetic reinforcement and SRW products. This allowed for the development of a generic material specification for the geosynthetic reinforcement and SRW products, thus removing the sole source specifying and bidding concerns for these products. The increased use of MSE SRW systems resulted in a greater amount of design and construction experience with these systems. Performance history was being generated and documented in research and case history publications. The St. Paul District was encouraged to use the MSE SRW systems and received advice regarding design methodologies and requirements and specification of the MSE SRW systems from outside. experienced consultants. These factors led to the use of MSE SRW systems in non-critical locations on flood control and reservoir projects in the St. Paul District starting in 1991.

ALTERNATIVE METHODS FOR SPECIFYING AND BIDDING MSE SRW SYSTEMS

General. Federal procurement regulations do not allow for pre-approval of the MSE SRW systems which have been developed by various vendors. Alternative methods for specifying and bidding the MSE SRW systems needed to be developed to allow for open and fair competition among suppliers. This required developing a wide open generic specification for geogrids and other geosynthetic reinforcement, SRW units, and geotextile filters, which spanned the rate of product properties found in the literature. Sources of this information included the IFAI Specifiers Guide and manufacturer and vendor literature.

The St. Paul District has developed three alternative methods for specifying and bidding MSE SRW systems. These methods, summarized in Table I, are discussed below. Use of the various alternative methods for specifying and bidding MSE SRW systems are illustrated in the case histories.Selection of the method to use is typicallv based on the geotechnical complexity of the site and problems anticipated to occur during the submittaI review process. All methods require review and approval of shop drawings by a professional engineer experienced in the design of MSE SRW systems prior to submittal to the COE.

Table 1. Summary of Methods Used To Specify and Bid MSE SRW Systems

Method No.	1	2	3
Information Presented in Contract Documents	Complete Design	Alignment, Grades, and Generic Wall Section	Alignment, Grades, and External and Compound Stability Requirements
Summary of Method	External, compound, and internal stability completed by St. Paul District Shop drawings prepared by PE	Requires design of wall to be completed by a PE Shop drawings prepared by PE	External and compound stability completed by St. Paul District Internal stability completed by PE Shop drawings prepared by PE
Advantages of Method	Consistent bid information provided Cost of design by PE not required if presented design is used	Quickest way to meet internal design schedules and minimize design budgets	Consistent bid information provided COE assured that design criteria are satisfied Consultants very good at optimizing internal stability
Disadvantages of Method	Additional design time required to prepare contract documents COE internal stability analysis not likely to be optimized - Contractor will revise design to optimize product use	Complete wall design must be provided by a PE Difficult submittal review and approval process likely for non-generalized site conditions	Additional design time required by St. Paul District to determine external and compound stability requirements

Method I: Present Complete Design. The basis behind this method is that the external, compound, and internal stability analyses are completed by the St. Paul District. The design and all information needed to construct the wall are presented in the contract documents. The-major advantages of this method are: (i) the information presented in the contract documents gives all contractors something consistent to bid on; and (ii) the costs involved with having a professional engineer complete a preliminary design during the bidding process are eliminated. The disadvantages associated with this method include: (i) additional design time and detailing; and (ii) often, the internal stability analysis will likely be redesigned and optimized based on the specific SRW block and geosynthetic reinforcement seIected by the contractor.

Method 2: Present Onlv Required Alignment and Grades. For this method, the required alignment and top and bottom of wall grades, and a generic cross section are provided in the contract documents. This is the quickest way to meet internal design schedules and minimize design budgets. This method requires the construction contractor to have the MSE SRW system completely designed by a professional engineer.

Consulting engineers who generallv design these wall systems are typically not familiar with COE design standards and the factors of safety required to complete the external and compound stability analyses (slope stability and bearing capacity). External and compound stability generally governs the required Iength of reinforcement on COE projects. Some designers still model the reinforced zone with an artificially high shear strength to prevent compound failure planes from passing through the reinforced soil mass, which can lead to unconservative external and compound stability factors of safety (Bern and Meyers, 1997). Most of the MSE SRW system design software used by consulting engineers which is typically developed by vendors, do not compute an allowable bearing capacity. An allowable bearing capacity is supplied by the user as required input to the software. The designer must be particularly aware of sloping fills in front of the wall system and water elevations in computing an allowable bearing capacity. These factors can contribute to a difficult submittal review and approval process.

Method 3: Present Required Alignment and Grades and External and Compound Stability Requirements. The use of this method requires the St. Paul District to complete the external and compound stability analysis. The alignment, grades, and minimum reinforcement lengths and strengths required to satisfy external and compound stability design criteria are presented in the contract documents. The construction contractor is left to complete the internal stability analysis for review and approval bv the COE. The advantage of this method is that the internal stability is the easier of the required analyses and consulting engineers are very good at doing this. Especially with respect to optimizing the spacing of the reinforcement for the MSE SRW system selected for use by the construction contractor. Also, by providing the external and compound stability designs. The contract documents set guidelines which are consistent for all bidders and the COE is assured that all COE design standards are satisfied.

CASE HISTORIES

General. This section presents four case histories from various projects constructed or being constructed in the St. Paul District. A comparative summary of the case histories with respect to the specfying and bidding method, bid results, estimated alternate wall type costs, and an estimated savings of using the MSE SRW system over the alternate wall system(s) considered is presented in Table 2.

Case History No. 1: Rochester. Minnesota Flood Control Project. Stage 2,B. Stage 2B of the Rochester, Minnesota Flood Control Project consisted of channel improvements through Soldier's Field Golf Course to optimize the hydraulic efficiency and capacity of the channel. The improvements required extensive widening and deepening of the existing channel and provided erosion protection for the channel side slopes.

The proposed channel improvements, utilizing 1V on 3H side slopes, would have required construction or repair of three greens and one tee box immediately adjacent to the channel, requiring closure of the golf course for aminimum of two seasons to establish a new green The City of Rochester, who owns the golf course, was willing to permit golf course closure for one construction season, but closure for two seasons was unacceptable, as it would impact the course rating and result in loss of revenue and clientele. To alleviate this concern the IV on 3H channel side slopes were replaced with a wall system, which could be constructed without impacting the greens and tee boxes.

A traditional cantilever wall would require a footing dimension which would impact the greens during construction. An anchored sheetpile wall system with a concrete cap was selected as the wall system to be used in the areas of the greens. Although functional, this wall system lacked the aesthetic quality requested by the City.

The COE typically completes an internal Value Engineering (VE) study of completed design projects with construction costs in excess of $2 million. The VE studv for Stage 2B completed in 1990 indicated a potential savings of S650,000 if a MSE SRW system were to be used in light of the anchored sheetpile wall system. An improved aesthetics benefit, although unquantifiable, would also be realized, which pleased the City of Rochester.

This was the first MSE SRW system bid by the St. Paul District. A precursor to Methods 1 and 3 was used to specify and bid the project. The contract documents for Stage 2B presented the government-designed MSE SRW system including aliment, maximum top-of-footing elevations, SRW requirements minimum reinforcement lengths, reinforcement properties, connection strength requirements, and backfill and compaction requirements. However, the construction contractor could choose to use the government design in its entirety, or redesign the reinforcement locations, spacing, and properties following AASHTO-AGC-ARTBA Task Force 27 recommendations. Such changes required submittal of computations or computer printouts identify into input parameters and

Table 2. Comparative Summary of Case Histories - Specification, Bidding, and Cost Data

Case History No.	Method Used	Bid Quantity m^2 (SF)	Bid Quantity Basis	Unit Price $\$/m^2$ ($/SF)	Total Cost $1000s	Alternate Wall System	Alternate Wall Cost $1000s	Estimated Savings $1000s
1	3	1,560 (16,800)	Vertical Projection Above Ground	161.50 (15.00)	250	Anchored Sheet Pile With Concrete Cap	900	650
2	1	15 (160)	Vertical Projection Above Ground	161.50 (15.00)	2	Concrete Cantilever (See Note 1)	9	7
3	2	74 (800)	Vertical Projection Above Base	215.28 (20.00)	16	Concrete Cantilever (See Note 1)	44	28
4 RS 1A-1E	2	862 (9,280)	Vertical Projection Above Base	191.06 (17.75)	164	MSE Wall With Concrete Panel Facing	306	142
4 RS 1	3	706 (7,600)	Vertical Projection Above Base	204.51 (19.00)	144	MSE Wall With Concrete Panel Facing	251	107
4 RS 3	3	1,663 (17,900)	Vertical Projection Above Base	199.13 (18.50)	331	MSE Wall With Concrete Panel Facing	591	260

Note 1: MSE SRW system selected based on constructibility and aesthetic concerns only. A cost was not estimated for the alternative wall system. Cost indicated is approximate based on bids received for other concrete wall work on the project.

verifying the proposed design changes. A VE proposal would have been required to make changes to alignment maximum top-of-footing elevations, minimum reinforcement lengths, or backfill and compaction requirements.

The construction contractor procured the services of a professional engineer to prepare shop drawings for submittal, review, and approval by the COE. The submittal proposed changes in reinforcement spacing and location and was accompanied by the appropriate computations and computer design results. The wall was completed in the summer of 1992. Although the MSE SRW system was not constructed in a consecutive manner or time frame, it is the opinion of the authors that the wall was constructed much more rapidly than either a conventional retaining wall system or an anchored sheetpile wall system could have been constructed.

The as-constructed MSE SRW system required 1,560 square meters (m^2) of exposed wall surface (16,800 square feet (SF)) and 8,305 meters squared (89,400 SF) of reinforcement in three wall reaches. The wall system has performed as designed, as evidenced by high river stages followed by rapidly falling river stages in early April, 1993.

Case Historv No 2: Rochester. Minnesota Flood Control Proiect. Stage 2.A. Stage 2.A of the Rochester, MN Flood Control Project runs through downtown Rochester. The majority of the wall systems utilized for this reach of the project were determined to be critical features of the project due to high velocities under flood conditions, horizontal curves and S-curves along the alignment, a multiple level path system geometry, and lack of right-of-way between the channel and adjacent transportation corridors. As such, traditional wall systems were used on most of Stage 2.A.

A single MSE SRW system was used as a grade control wall adjacent to a commercial building along the recreation trail in one small area of the Stage 2.A. project. This wall was approximately 9.1 m (30 feet) long and varied in exposed height-from 0.6 m (2 feet) to2.1 m (7 feet) for a total exposed wall surface area of 15 m^2 (160 SF). The foundation materials generally consisted of relatively clean granular materials and the groundwater level was below the level of influence of the wall. The wall was not subject to flooding. The backfill for the wall was nearly horizontal and the ground slope in front of the wall was horizontal. The design conditions were simple with no complicating factors requiring significant detailed analyses.

The MSE SRW system was selected for use because it was able to provide a low cost, easily constructed, aesthetically pleasing structure in this highlv visible area. Two other areas of the project used low height SRWs similar in appearance to that proposed for this wall. Economics was not formally considered in the selection of this wall. However, a traditional concrete cantilever retaining wall would have required a much deeper and wider footing. This would increase excavation backfill, wall height, and reinforcement requirements, resulting in a more costly wall system than the MSE SRW system selected for use.

The contract documents were developed utilizing Method 1, with the required alignment grade, reinforcement lengths, and reinforcement spacing for the wall presented in tie drawings. No modifications to the design were allowed but the consmxtion contractor was required to submit traditionaI shop drawings for review and approval by the COE. Mimurn product requirements were specified. The construction contractor procured the services of a local professional engineer experienced in the design of MSE SRW systems to prepare the shop drawings and the wall was quickly and easily designed and constructed. Minimal analyses were complete: for the design due to the uncomplicated conditions and low risk of damage or loss of life associated with wall failure.

Case Historv No. 3 :Upper St. Anthony Fails Visitors Center. Upper St. Anthony Falls Lock and Dam located in Minneapolis, Minnesota, is the most upstream lock and dam on the Mississippi River operated and maintained by the COE. Work to improve the accessibility for visitors to the site required the construction of a small retaining wall. The average height of wall was approximately 1.8 m (6 feet), with a maximum height of 2.4 m (8 feet), resulting in a total wall area of approximately 74 m (800 SF).The foundation materials generally consisted of relatively clean granular materials and the groundwater level was below the level of influence of the wall. The backfill for the wall was nearly horizontal and the ground slope in front of the wall sloped gradually away from the wall to a roadway so that its influence on the bearing capacity was negligible. The design conditions were simple with no complicating factors requiring significant detailed analyses.

An MSE SRW system was selected for use on this project to provide a low cost, aesthetically pleasing structure in this highly visible area. The contract documents were developed utilizing Method 2, with the required alignment and grade for the wall presented in the drawings. The contractor was required to submit the complete wall system design and shop drawings for approval by the COE. Minimum product requirements were specified and a typical wall section was included to identify the basic wall requirements. The contractor procured the services of a local professional engineer experienced in the design of MSE SRW systems and the wall was quickly and easily designed and constructed. Minimal analyses were completed for the design due to the uncomplicated conditions and low risk of damage or loss of life associated with wall failure.

Case History No. 4: Lake Red Rock Multi-Purpose Trail Segment 4.A. The Lake Red Rock Multi-Purpose Trail project is located along the northern shore of Lake Red Rock near Pella, Iowa. Lake Red Rock is the pool created by the COE Rock Island District Red Rock Dam. The Rock Island Distict is currently constructing a bituminous recreation trail along a portion of the perimeter of the pool. Retaining structures are needed in areas where right of way limits restrict the placement of sloping fill or cuts or in areas where the trail is adjacent to a high roadway embankment and the placement of fill needed for trail construction would be significant. The Rock Island Distict decided to use MSE SRW systems for the retaining structures and contracted with the St. Paul District to prepare the required design documents. Two approaches, Methods 2 and 3, were used in specifying and bidding the retaining structures as discussed in the following paragraphs.

A total of eight separate MSE retaining systems were used on this project, seven MSE SRW systems and one MSE reinforced slope. Five of the MSE SRW systems were relatively low height structures. Standard design conditions for these walls allowed the use of Method 2, specifying lines and grades in the contract documents and requiring the contractor to use a professional engineer to complete the design. The total design package for the five smaller walls was also required to be submitted for review and approval by the COE.

The remaining two MSE SRW systems, with total wall heights up to 16 feet (4.9 m), represented 3,369 m2 (25,500 SF) of the total 3.3m^2 (213,780 SF) of wall. They were constructed on the sideslope of an adjacent highway embankment. Significant portions of these walls would be inundated by the design pool of Red Rock Dam. Since the external and compound stability conditions were required to satisfy COE design criteria and procedures, and in order to insure equitable bids, it was decided to utilize Method 3 to specify and bid these wall systems. Therefore the COE completed the external and compound stability (slope stability; bearing capacity;sliding analyses overturning) and drain and filtrationdesign in-house. These requirements were provided in the bid documents, along with required alignments and grades. The remaining design items as well as a check of the slope stability, were required to be designed by a professional engineer and submitted for review and approval by the COE.

The bid documents for the two larger walls included all external and compound stability criteria for the MSE SRW system. This criteria included: elevation of the top of the wall; wall embedment and bottom geogrid reinforcement elevation requirements; minimum geogrid reinforcement lengths; drain and backfill material gradations; geotextile materials; and required compaction and quality control testing; and minimum SRW concrete unit requirements. The contract documents included soil parameters and design criteria for the contractor to complete the internal and compound analyses, as well as a design check of the external stability. The construction contractor used a professional engineer to complete sufficient slope stability analyses and a bearing capacity check to verify the government design, as well as the internal stability analyses. Internal stability was analyzed in accordance with the NCMA design manual (Simac. et al. 1992).

This bidding approach worked very well and eased the submittal review process. The COE rigorous analyses of the external and compound stability for the larger, non-standard design walls required geogrid reinforcement Iengths longer than some of the wall and slope heights. The presentation of **these** geogrid reinforcement requirements in the bidding documents eliminated the potential problems associated with shorter geogrid lenghts generally assumed to secure a competitive bid versus the required geogrid reinforcement length based on detailed design performed after the contract is awarded.

LESSONS LEARNED

Specifying MSE SRW Systems. The St. Paul District's preferred use of the various alternative methods for specifying and bidding MSE SRW svstems has been based upon experiences with various projects and site conditions: The St. Paul District typically uses Method 1 for very short, simple wall systems which require reinforcement but where minimal time is projected to be spent reviewing the shop drawing submittals. Method 2 is utilized for wall systems of moderate height, such a wall which is less than 3.4 to 3 m (8 to 10 feet) in exposed height, and where difficult foundation conditions or other uncertainties do not exist at the site. In such cases, the contractor can usually provide an adequate design. Method 3 is used for almost ail other cases.

Bid Items and Measurement and Payment. The selection of appropriate bid items and descriptions used in the measurement and payment discussions regarding the bid items in the contract documents evolved based on experience. Typically, the MSE SRW systems have one bid item, MSE Wall, which is bid either per exposed verticallv projected wall surface area or per total verticallv projected wall surface area (top of leveling pad to top of wall). This bid item includes all labor, SRW units, geogrid reinforcement, geotextile filter, leveling pad drainage material, drain pipe and stubouts, excavation, backfill, and heavy equipment required to construct the wall as per the specifications. Note that the bid item is the vertical projection of the exposed or total wall area. For exposed projection, the bid item unit cost determined by the contractor must include the cost of all block and reinforcement below finished grade and may account for the batter required by the SRW system selected by the construction contractor.

Construction of MSE SRW Systems. Several advantages of constructing MSE SRW systems have been noted based on observations made during visits to COE construction projects where MSE SRW systems have been constructed. All of these advantages contribute to the lower cost of MSE SRW systems. These advantages are discussed in the following paragaphs.

The sequencing of construction appears to be much more flexible than construction of conventional wall systems. The Rochester 2B construction contractor moved his crews from wall to wall, regardless of whether the wall was completed or not, depending on adjacent construction activities, availability of equipment and materials, and whether the crew was needed elsewhere for a short period of time.

Dewatering costs can be minimized with MSE wall systems. The wall can be constructed to an elevation above which the dewatering system can be removed and/or above which flooding will not impact construction of the wall and adjacent areas. The Rochester construction contractor utilized this scheme and left the walls in a partially completed state for several weeks without impacting the project.

A line and grade construction grade with unskilled laborers can be utilized instead of a typical wall forming crew. A line and grade foreman is typically used to insure time and grade requirements are met, especially for the first several courses of SRW units. The unskilled laborers then place the SRW units and the reinforcement as specified in the approved shop drawings.

Heavy construction equipment such as cranes are not needed to construct the wall. The SRW units weigh on the order of 38 to 45 kg (85 to 100 pounds) each and can be carried by one person. Some segmental block unit manufacturers supply a hand held device for carrying and placing the SRW units. The reinforcement, and geotextile, if required, is unrolled and placed by hand. A small loader is used to place backfill lifts, which are then compacted using hand-operated compaction equipment.

The St. Paul District geotechnical engineers have noted one disadvantage of MSE SRW system construction. This is the often unfarmiliaritv of construction details by COE inspectors and large construction contractors who generally are awarded COE construction contracts. MSE SRW svstem suppliers are required bv the specification to provide experienced installers to assist the construction contractor during the early stages of the MSE SRW system. However, the installation learning curve for both the construction contractor and the inspectors can be substantial. Care for detail must be continual to insure bulges or misalignments are minimized.

CONCLUSIONS

The St. Paul District of the U.S. Army Corps of Engineers has successfully designed and constructed several MSE SRW systems in riverine and reservoir environments. Alternative methods for specifying and bidding MSE SRW systems have evolved over the last several years based on experiences with various methods. Today: three methods are utilized to specify and bid MSE SRW svstems, depending on the geotechnical complexity of the site and problems' anticipated to occur during the bidding and submittal review process. The three methods are presented, discussed, and supported by case histories in this paper.

The MSE SRW systems provide a cost-effective and highly aesthetic alternative to conventional wall systems for minimizing the affect of civil work flood control projects. In addition to cost savhos and aesthetic value, other advantages of the MSE SRW systems include reduced construction time, flexibility of construction sequencing minimization of dewatering costs, use of lower cost construction crews, and the absence of heavy construction equipment.

The St. Paul District's experience with MSE SRW systems has resulted in a great interest by other COE Districts to use these wall systems. Typically these Districts and their local sponsors have selected MSE SRW systems after discussions with the St. Paul District geotechnical engineers and local sponsors and site visits to the projects where MSE SRW systems are used.

RECOMMENDATIONS

The methods used by the St. Paul District to specify and bid MSE SRW systems are presented in this paper. Based on a progressive use of MSE SRW systems, the methods have been refined. Use of the methods as discussed herein should minimize concerns during the bidding and shop drawing submittal and review processes. This recommendation is the opinion of the authors and does not necessarily represent the opinion of the U.S. Army Corps of Engineers or the St. Paul District.

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Berg, R.R., and Meyers. MS., (1997), "Analysis of the Collapse of a 6.7 m High Geosynthetic-Reinforced Wall Structure", Geosynthetics 97 Conference Proceedings.

Meyers, MS., and Schwanz, NT., (1993) "MSE Segmental Block Wall System in a Riverine Environment", Geotechnical Fabrics Report, Volume 11, Number 4, pp. 22-27.

Simac, M.R., Bathurst, R.J., Berg, R.R., and Lothspeich, S.E., (1993) "Design Mannual For Segmental Retaining Walls (Modular Block Retaining Wall Systems), First Edition", National Concrete Masonry Association, Herndon, Virginia.

U.S. Army Corps of Engineers, (1989)"EM 1110-2-2502, Retaining and FIood Walls", U.S. ARMY Corps of Engineers, Washington D.C.

U.S. Army Corps of Engineers, (1990)"ETL 1110-2-322, Retaining and Flood Walls", U.S. ARMY Corps of Engineers, Washington, D.C.

SHEET 1 OF ________ SHEETS

RECOMMENDED CHANGES TO ENGINEERING DOCUMENTS

(Submit a separate form in quadruplicate for each report)

(ER 1110-345-100)

OFFICE SYMBOL AND DATE

CEMVP-PE-D
20 May 1997

DOCUMENT NUMBER AND DATE

Proposed

DOCUMENT TITLE

1) Mechanically Stabilized Earth Walls (MSEW)
2) Reinforced Steep Slopes

DOCUMENT TYPE

DRAWING ([STANDARD] [DEFINITIVE)

X SPECIFICATION ((GUIDE) (STANDARD])

DESIGN GUIDES

TECHNICAL MANUAL

ENGINEER MANUAL

ENGINEER REGULATION

OTHER

MILITARY

X CIVIL WORKS

SUBJECT Mechanically stabilized earth technologies applied to segmented retaining walls and steepened slopes

ROUTING (Check)

FROM

District Commander
U.S. Army Engineer Dtstrict,
St. Paul

ACTION RECOMMENDED BY DISTRICT COMMANDER

(see sheet 2)

OFFICE SYMBOL CEMVP

NAME AND TITLE (Print or Type) J.M. WONSIK, COL, EN Commanding

DATE 4 Jun 96

SIGNATURE

Ia. TO.

HOUSACE (CEMP-EA)
WASH DC 20314-1000

INFORMATION COPY OF THIS ENG FORM 3078 WAS SENT ________________

(Date)

Ib. TO.

Division Commander
U.S. &my Engineer Division,

COMMENTS. ACTION, OR RECOMMENDATION BY DIVISION COMMANDER

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NAME AND TITLE *(Print or Type)*

DATE

SIGNATURE

2 TO.

HOUSACE (CEMP-EA)
WASH DC 20314-1000

COMMENTS OR ACTION BY COMMANDER, USACE

OFFICE SYMBOL

NAME AND TITLE (Print or Type)

DATE

SIGNATURE

3. TO.

Division Commander
U.S. Army Engineer Division,

COMMENTS BY DIVISION COMMANDER

OFFICE SYMBOL

NAME AND TITLE *(Print or Type)*

DATE

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4 RETURN *TO.*

Dlstrict Commander
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RECOMMENDED CHANGES TO ENGINEERING DOCUMENTS (Cont'd)

OFFICE SYMBOL AND DATE
CEMVP-PE-D
20 May 1997

PROBLEM DISCRIPTION AND ACTION RECOMMENDED *(Use additional sheets if necessary.)*

1. PROBLEM

Advancing technologies incorporating geosynthetics in wall and soil slope construction have resulted in significant cost savings over conventional wall Systems. Private industry and the Federal Highway Administration (FHWA) have been instrumental in the development and advancement of using extensible and inextensible soil reinforcement in mechanically stabilized earth (MSE) structures. Based on these developments and the available history of performance, the St. Paul District has designed, bid and constructed a number of these structures.

The lack of standard specifications for MSE walls and slopes has required the District to develop specifications to conform to the Corps of Engineers bidding process. The developed specifications (examples attached) have been written specifically for each project depending on the selected design approach. Different design approaches have been used by the St. Paul District as identified in the attached paper "Specifying and Bidding Segmental Concrete Faced MSE Walls on U.S. Army Corps of Engineers, St. Paul District Projects." Generic specifications should be developed for MSE walls and reinforced steep slopes to produce sound, economical structures and promote the use of reinforced soil systems.

2 RECOMMENDED SOLUTION-

Provide the authority and funding to the St. Paul District to develop standard specifications for MSE walls and for reinforced steep slopes. The St. Paul District will build upon the existing District specifications using expertise gained from constructed projects. Please contact Mr. Al Geisen if you have questions.

NAME OF SUBMITTER (Optional)	WORK TELEPHONE NUMBER (Optional)
ALLEN L. GEISEN	(612)290-5522

SECTION 02956

SEGMENTAL CONCRETE RETAINING WALL

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2	PRODUCTS	029563
3	EXECUTION	02956-5

SECTION 02956 - SEGMENTAL CONCRETE RETAINING WALL

1. **GENERAL.**

SCOPE:

1.1.1 This work shall consist of designing, furnishing, and constructing soil-reinforced segmental concrete retaining wall systems to the lines, grades, and dimensions shown on the drawings and in accordance with these specifications. Construction drawings and design calculations for the retaining wall systems shall be prepared by a registered professional engineer, and shall bear the engineers signature and seal.

1.1.2 The work includes but is not limited to excavation, and furnishment and installation of the leveling pad, segmental wall units, soil reinforcement, reinforced and retained backfill material, and drainage materials.

1.1.3 The Contractor shall have a qualified and experienced representative from the geogrid manufacturer available on an as-needed basis. The representative shall visit the site to resolve construction difficulties as requested by the Contracting Officer. If the workforce responsible for erecting the wall does not specialize in segmental concrete retaining wall construction, then the representative shall be on-site the first day of deployment of the geogrid.

1.2 RELATED WORK OF OTHER SECTIONS: The following items of related work are covered under other sections.

(1) Reinforced Backfill, Compaction and Testing: SECTION: GRADING.

1.3 APPLICABLE PUBLICATIONS: The following publications for the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

American Societv of Testing and Materials (ASTM):

C 90-96	Load bearing Concrete Masonry Units
C 140-96	Sampling and Testing Concrete Masonry Units.
D 698-91	Moisture Density Relationship for Soils, Standard Method
D 2922-91	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths)
D 3017-88	Moisture Content of Soil and Rock in Place by Nuclear Methods (Shallow Depths)
D 4491-95	Water Permeability of Geotextiles by Permittivity
D 4595-86	Tensile Properties of Geotextiles by the Wide-Width Strip Method
D 4632-91	Grab Breaking Load and Elongation of Geotextiles
D 4751-95	Determining Apparent Opening Size of a Geotextile
D 4833-88	Index Puncture Resistance of Geotextiles, Geomemebranes, and Related products

Geosynthetic Research Institute (GRI)

GG4	Determination of the Long-Term Design Strength of Stiff Geogrids

Wisconsin Department of Transportation (WisDOT) Standard Specifications for Construction (1996 Edition).

304	Crushed Aggregate Base Course
501	Coarse Concrete Aggregate

National Concrete Masonrv Association (NCMA)

SRWU-1	Determination of Connection Strength between Geosynthetics and Segmental Concrete Units
SRWU-2	Determination of Shear Strength between Segmental Concrete units
	Design Manual for Segmental Retaining Walls, 1st Edition, 1993

1.4 SUBMITTALS: The following items shall be submitted in accordance with SECTION: SUBMITTAL PROCEDURES.

1.4.1 Manufacturer Data: The Contractor shall submit descriptive technical data on the modular block, wall caps, masonry adhesive, geogrid and geotextile materials. The submittal shall include all material properties specified under HEADING: MATERIALS.

1.4.2 Calculations and Shop Drawinqs: The fabrication and installation drawings and design calculations, including computer output data, shall be submitted. The calculations and shop drawings shall include all items described under HEADING: SEGMENTAL CONCRETE RETAINING WALL DESIGN.

1.4.3 Certificates of compliance stating that the materials provided meet the requirements specified.

1.4.3.1 Geogrid reinforcement: The Contractor will furnish the Contracting Officer with written certification from the manufacturer that all purchased resin used to produce the structural geogrid reinforcement is virgin resin.

1.4.4 Seamental Concrete Units: The Contractor shall submit for approval two samples of each proposed block. Each sample shall be typical of the size, texture, color, and finish.

1.5 MEASUREMENT AND PAYMENT:

1.5.1 Segmental concrete retaininc wall will be measured for payment by the square foot of face area in the vertical plane of segmental concrete units. Payment will extend from neat lines from the base of blocks to the top of wall. Payment by the listed bidding schedule items in the section will include compensation for all incidental costs, including associated excavation, fill, backfilling, subgrade preparation, drainage aggregate, geogrid, geotextile, aggregate base and other related work.

1.6 BIDDING SCHEDULE ITEMS applicable to the work of this section are as follows:

Item	Unit
Segmental Concrete Retaining Wall	SF

2. PRODUCTS

2.1 DEFINITIONS.

2.1.1 Geogrid. A structural element formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth and function primarily as reinforcement.

2.1.2 Segmental Concrete Unit. A concrete block specifically designed for retaining wall applications, and machine made from portland cement, water, and mineral aggregates. The individual units shall also be referred to as blocks.

2.1.3 Drainage Aggregate. Granular soil which is placed within, between, and/or immediately behind segmental concrete units.

2.1.4 Reinforced Backfill. Compacted soil which is within the reinforced soil volume as outlined on the plans.

2.1.5 Wall Design Engineer: A registered professional engineer acting on behalf of the Contractor, to design the segmental retaining wall system and insure the wall is constructed as designed and in accordance with these specifications.

2.2 MATERIALS

2.2.1 Segmental Concrete Units. The blocks shall be manufactured to the general requirements of ASTM C 90, "Load Searing Concrete Masonry Units", except as otherwise specified herein. All blocks shall be sound and free of cracks or other defects that would interfere with the proper laying of the block or significantly impair the strength or permanence of the construction. Minor cracks incidental to the usual method of manufacturer or minor chipping resulting from shipment and delivery are not grounds for rejection. Exterior dimensions of the block shall not vary more than l/8 inch (3.2 mm) from the specified dimension, except the height shall not vary more than l/16 inch (1.6 mm) from the specified dimension.

2.2.1.1 Architectural requirements:

(1) Face color - pigmented to closely match natural limestone (tan, beige).

(2) Face finish - straight and split to present a stone texture as available from manufacturer and approved by the Contracting Officer; rounded or faceted blocks will not be acceptable.

(3) Bond configuration - running with bonds nominally located at midpoint of vertically adjacent blocks;

(4) Batter - Blocks shall be positively engaged to the block below so as to provide between a minimum of 3/4 inch and a maximum of 2 inches horizontal setback per vertical foot of wall height (batter between 1:6 and 1:16).

(5) Block Size - a minimum of Z/3 square feet of face area, and minimum 6 inch height.

2.2.1.2 Structural requirements:

(1) Minimum 28-day compressive strength of 4500 psi, based on net area in accordance with ASTM C 140.

(2) Adequate freeze/thaw protection with a maximum moisture absorption rate of 6 percent, in accordance with ASTM C 140.

(3) Blocks shall connect with a positive interlock by use of a key or connecting pins. The shear strength between blocks shall be established in accordance with NCMA SRWU-1.

(4) The connection strength between the blocks and the geosynthetic reinforcement shall be established in accordance with NCMA SRWU-2.

(5) The block weight shall provide a minimum of 100 pounds per square foot of wall face area. Fill which is contained within the dimensions of the units may be considered as 80 percent effective weight.

2.2.2 Wall Caps: Precast concrete units shall be placed as caps on top of all segmental concrete retaining walls. The cap blocks shall have a color and texture on exposed faces to match that of the other blocks and meet the requirements for the other blocks except that the minimum height shall be 3 inches. Each cap block shall have abutting edges saw cut or formed to provide tight, flush abutting joints with no gaps in the joints when placed end to end in the alignment shown on the drawings.

2.2.3 Masonry Adhesive: The type of masonry adhesive utilized to bond the wall caps to the upper modular blocks shall be as recommended by the block manufacturer.

2.2.4 Aggregate Base material for the wall footings shall meet the requirements of WisDOT 304, gradation No. 2.

2.2.5 Backfill. Soil placed in and behind the reinforced zone shall consist of sand fill as defined in SECTION: GRADING.

2.2.6 Drainage Aggregate shall meet the requirements for coarse concrete aggregate of WisDoT 501, size No. 1.

2.2.7 Geotextile. The geotextile shall consist of a needle punched nonwoven fabric composed of plastic yarn. The geotextile shall meet the physical requirements listed in Table 1. The geotextlle fiber shall consist of a long-chain synthetic polymer composed of at least 85% by weight of propylene, ethylene, ester, amide or vinylidene-chloride, and shall contain stabilizers and/or inhibitors added to the base polymer to make the filament resistant to deterioration due to ultra-violet light and heat exposure.

Table I. Physical Requirements for Geotextile		
PHYSICAL PROPERTY	TEST PROCEDURE	ACCEPTABLE VALUES +
Grab Tensile Strength	ASTM D 4632	200 pounds, machine and cross directions
Puncture Strength	ASTM D 4833	80 pounds
Apparent Opening Size, AOS	ASTM D 4751	No finer than U.S. Standard Sieve No. 100 and no coarser than No. 70 sieve.
Permittivity	ASTM D 4491	0.5 per second

\+ All numerical values, except AOS, represent minimum average roll values.

2.2.8 Geogrid. The geogrid shall consist of a regular integrally connected longitudinal and transverse polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil, aggregate, or other fill material. The geogrid shown on the contract drawings and required for global stability shall meet the physical requirements listed in Table- 2. The geogrid shown in the approved shop drawing submittal and required for internal and local stability shall meet the physical requirements used in the design. The resin used to produce the geogrid shall be 100% virgin resin.

Table 2. Physical Requirements for Geogrid		
PHYSICAL PROPERTY	TEST PROCEDURE	ACCEPTABLE VALUES ++
Wide Width Tensile Strength	ASTM D 4595	1200 lb/ft @ 5% strain
Long Term Design Strength	GRI GG4	170.0 lb/ft

++ All numerical values represent minimum average roll values.

3. EXECUTION

3.1 SEGMENTAL CONCRETE RETAINING WALL DESIGN.

3.1.1 Desion. The Contractor shall complete the internal and local stability analyses in accordance with recommendations of the NCMA Design Manual for Segmental Retaining Walls, based upon the structure being critical. Calculations shall include determination of long term design strength of reinforcement specific to this project in accordance with GRI GG4, or the NCMA manual. Calculations shall include analysis of all failure modes listed in the NCMA manual. Design calculations shall include a clear outline of material properties and assumptions. The design shall meet the following criteria:

(1) The long term design strength of the lowest three geogrid layers shall equal or exceed the requirements listed in Table 2.

(2) The Contractor shall use the following reinforced and retained earth design parameters and water elevation for stability designs:

Moist Unit Weight, Y_M = 115 pcf,
Angle of Internal Friction, ϕ =30 degrees

Cohesion, c = 0 psf,
Water Elevation: 645.5 feet.

3.1.2 Layout. The Contractor shall then design and layout the necessary internal reinforcement, subject to the following:

(1) All geogrid lengths shall be no less than the lengths shown and all features indicated in the contract documents shall be incorporated in the final design and construction.

(2) The base of wall elevations may vary,but shall be no higher than the embedment depth profile shown.

(3) The geogrid shall be laid out so that interference with the geotextile is minimized. Each reinforcement level shall run continuous throughout the profile.

3.1.3 Shop Drawings. Shop drawings shall be submitted and shall reflect all information needed to fabricate and erect the walls including the base of wall elevations;the shape and dimensions of wall elements; the number, size, type, and details of the soil reinforcing system and anchorage; and any required coping.

3.2 DELIVERY, STORAGE AND HANDLING:

3.2.1 Segmental Concrete Units, and Wall Caps: The materials shall be checked upon delivery to assure that the proper units have been received and that the block dimensions are within the tolerances specified. The Contractor shall protect the materials from damage and shall prevent excessive mud, wet cement, epoxy, and like materials which may affix themselves, from coming in contact with the Concrete blocks. Damaged blocks shall not be incorporated in the retaining wall.

3.2.2 Geosynthetics. During all period of shipment and storage, geosynthetics shall be protected from prolonged periods of direct sunlight, and protected from temperatures greater than 140 degrees Fahrenheit and below 20 degrees Fahrenheit or as recommended by the manufacturer. The Contractor shall inspect the geosynthetics upon delivery to assure that the proper material has been received and is undamaged. The materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Rolled materials shall be laid flat or stood on end when stored. The Contractor shall prevent excessive mud, cement, epoxy, and like materials from coming in contact with the geosynthetics. Geosynthetics shall not be dragged or dropped.

3.3 INSTALLATION:

3.3.1 Excavation: Foundation soil shall be excavated as required for footing dimensions and geogrid placement shown on the construction drawings. Foundation soil shall be excavated in conformance with SECTION: GRADING.

3.3.2 Subgrade Preparation and Footing:

3.3.2.1 For a portion of the wall, the blocks will be founded on a concrete leveling pad as shown on the drawings. The leveling pad shall be poured in the dry, or in calm standing water that is protected from waves or moving water. Pumps or drainage shall be provided to force water progressively out of the forms. Tolerances in screeding shall be sufficient to place the blocks directly on the leveling pad without mortar, pointing, or leveling course between the blocks and leveling pad.

3.3.2.2 For the remainder of the wall where a concrete leveling pad is not indicated, the blocks may be placed on an aggregate base footing. The subgrade below the footing shall be compacted with at least 3 passes with a vibratory manual plate tamper. The aggregate base material, shall be placed in 6 inch lifts and also compacted with at least 3 passes with a vibratory manual plate tamper.

3.3.4 Block Installation: The wall system components shall be constructed in accordance with the wall supplier's recommendations and construction manual.

(1) The first course of modular block units shall be placed on the prepared footings. Block placement shall begin at the lowest footing elevation. The units shall be checked for level and alignment and shall be approved by the Contracting Officer prior to placing the second course. Proper placement of the first course is most important to insure accurate and acceptable results.

(2) Insure that the wall units are in full contact with the footing.

(3) Units shall, be placed tight side by side for the full length of the wall alignment (do not gap). Alignment shall be done by using a string line OK offset from a base line.

(4) Vertical alignment of block contacts shall be maintained. Coping required to keep lock alignment shall be done with a full depth saw cut. No splitting shall be allowed.

3.3.4.l Alignment Tolerances:

(1) Horizontal: Plus 0.5 feet to minus 0.5 feet at the top of wall from location shown on drawings, and within 0.1 feet deviation from straight alignment.

(2) Vertical: The top of footing elevations shall be within zero (0) to one-half (1/2 foot below the prescribed top of footing elevation shown on the drawings. The top of wall elevations shall be within 0.1 foot above to 0.1 foot below the prescribed top of wall elevations shown on the drawings. •

(3) Plumbness: The batter on the retaining wall shall conform to the block manufacturers recommendations.

(4) Alignment: The walls shall be constructed such that bulging of the wall face is not evident. Bulging in excess of 1 inch over a horizontal or vertical distance of 10 feet shall be grounds for dismantling and reconstructing the wall.

3.3.5 Geoarid Installation.

(1) Before deploying geogrid, the subgrade shall be graded level, smooth, and free of windrows and rocks.

(2) Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignment.

(3) Geogrid shall be placed at the elevations and to the extent shown on the construction drawings and the approved shop drawing submittal.

(4) The geogrid shall be laid horizontally on compacted backfill. The geogrid shall be pulled taut and anchored with stakes prior to backfill placement on the geogrid.

(5) Geogrid shall be-continuous from the block connection to the embedment length. Spliced connections between shorter pieces of geogrid will not be allowed.

(6) All geogrid shall be 100% covered by soil so that no two geogrid panels contact in overlaps. Where the wall bends, the geogrid panels that overlap shall be separated by at least 3 inches of fill.

3.3.6 Backfill Placement.

(1) Backfill placement shall closely follow erection of each course of facing blocks. Backfill which does not meet the requirements of SECTION: GRADING shall be corrected or removed and replaced at the Contractor's expense, as directed by the Contracting Officer.

(2) Reinforced backfill shall be placed from the wall back toward the fill area to ensure that the geogrid remains taut. Backfill shall be placed, spread, and compacted in such manner that minimizes the development of wrinkles in or movement of the geogrid.

(3) Construction equipment shall not be operated directly upon the geogrid, except that small rubber-tired equipment may pass over geogrid at slow speed if approved by the Contracting Officer. A minimum fill thickness of 6 inches is required prior to operation of vehicles over the geogrid. Sudden braking and sharp turning shall be avoided. Tracked equipment shall not turn within the reinforced fill zone to prevent tracks from displacing the fill and damaging the geogrid.

(4) Reinforced and retained earth backfill shall be compacted to 95% Maximum Standard Density (ASTM-D-698). Care shall be exercised in the compaction process to avoid misalignment of the facing blocks. Heavy compaction equipment (including vibratory drum rollers) shall not be used to compact backfill within a horizontal distance from the wall face equal to the vertical rise above the toe of the wall.

(5) Drainage aggregate shall be placed and tamped directly behind, between, and within the cells of the facing units. Granular fill shall not be placed within the holes provided for the connection pins. Compaction of the drainage aggregate shall be achieved by at least two passes on each lift with a manual vibratory tamper. Care shall be taken not to contact or chip the blocks with the compactor. Aggregate placed within the block cores and recesses shall be compacted by hand tamping and rodding.

3.3.7 Completion: Install cap units on the finished wall. Cap units shall be joined to the top units using manufacturer-supplied adhesive. Care shall be taken to keep adhesive from coming into contact with the face of wall units. Upon completion of wall erection, the Contractor shall clean the wall face to remove any loose soil deposits or stains.

3.3.8 Protection of Work: Work shall be protected against damage from subsequent operations. Disturbed or displaced blocks shall be removed and replaced to conform to all requirements of this section.

3.4 SAMPLING AND TESTING:

3.4.1 Compaction of Reinforced backfill: Field and laboratory tests shall be made in accordance with SECTION: GRADING.

3.4.2 Gradation of Drainage Aaareaate: Laboratory tests shall be made in accordance with SECTION: GRADING.

--END OF SECTION--

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SECTION 02777 - REINFORCED SOIL SLOPE SYSTEM, RETAINING STRUCTURE NO. 2

PART 1 GENERAL

DESCRIPTION OF WORK

This work shall consist of designing, furnishing, and constructing reinforced soil slope systems in reasonably close conformity with the lines, grades, and dimensions shown on the drawings and in accordance with these specifications. Construction drawings and design calculations for the reinforced soil slope systems shall be prepared by a registered
professional engineer, with minimum of three years experience in the *
design of reinforced soil slope system, and shall bear the engineers *
signature and seal.

1 1.2 The work includes, but is not limited to, excavation as required, furnishing and installing structural geogrid soil reinforcement, reinforced and retained backfill material, seeding and turf reinforcement matrix, furnishing and installing topsoil; and furnishing and installing drainage materials.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1 2.1 American Society for Testing and Materials (ASTH)

D 2487-93	Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

1.2.2 Iowa Department of Transportation (IDOT)

Standard Specifications for Highway and Bridge Construction (Series of 1992 and General Supplemental Specifications)

1.2.3 U.S. Department of Transportation, Federal Highway Administration

1.3 REINFORCED SOIL SLOPE DESIGN

1.3.1 The contract documents include information regarding the minimum lengths of geogrid reinforcement and maximum elevation of the lowest layer of geogrid reinforcement for the reinforced soil slope. The Contractor shall analyze the external, internal, compound, sliding, and local stability analyses in accordance with the design procedure presented in FHWA-SA-93-025, and shall incorporate the design requirements shown in the contract documents. The lowest soil reinforcement layer elevations may vary, but shall be no higher than indicated on the drawings. The design strength of the lowest reinforcement layers, shown within the granular backfill, shall be determined by the slope design engineer. Geogrid lengths shall be determined by the slope design engineer, but in no case shall the length of the bottom reinforcement be less than the lengths shown.

1.3.2 The Contractor shall use the following soil parameters and design requirements for internal and local stability designs:

Soil Type	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Angle of Internal Friction (degrees)	Cohesion (psf)
Granular Material	118	120	30	0
Reinforced Slope Fill	120	123	27	0
In-Situ Embankment and Foundation	120	123	23	100

Design Pool (Water Level Elevation): 780 feet (MSL)

Surcharges: DL: 120 psf
LL: 80 psf

Design Factors of Safety: Global (deep seated): 1.4 minimum
Internal: 1.3 minimum
Compound: 1.3 minimum
Sliding (on lowest grid): 1.5 minimum

1.4 SUBMITTALS

Submit the following in accordance with the provisions of Section 01305 SUBMITTAL PROCEDURES:

1.4.1 The fabrication and installation drawings and design calculations, including computer output data and computer program details, shall be submitted to the Contracting Officer for approvai at least 60 days prior to beginning slope construction. The drawings shall reflect all information needed to construct the reinforced slopes including the bottom geogrid elevations, the number, size, type, and details of the soil reinforcing system and anchorage, and any additional details pertaining to turf establishment, drainage, or surface erosion control as required by the contract.

1.4.2 Descriptive technical data on soil and turf reinforcement.

1.4.3 Notarized manufacturer's certification signed and sealed by an officer of the company stating that the geosynthetic reinforcement meets the requirements of this specification. The Contractor will furnish the Contracting Officer with written certification from the manufacturer that all purchased resin used to produce the structural geogrid reinforcement is virgin resin.

1.4.4 Results of determination of the long term design strength of reinforcement as discussed in FHWA-SA-93-025.

1.4.5 Test results showing that the gradation and density of the granular backfill and the reinforced slope fill materials meet the requirements of these specifications.

PART 2 PRODUCTS

2.1 DEFINITIONS

2.1.1 Structural Geogrid: A structural element formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth and function primarily as reinforcement.

2.1.2 Reinforced and Retained Backfill: Soil which is placed between and behind the geogrid reinforcement. Soil which is within the reinforced soil volume as outlined on the drawings is termed the reinforced backfill. Soil placed between the reinforced backfill and the excavation cut or embankment is termed the retained backfill.

2.1.3 Slope Design Engineer: A registered professional engineer, acting on behalf of the Contractor, to design the reinforced soil slope system and ensure the slope is constructed as designed and in accordance with these specifications.

2.2 TURF REINFORCEMENT MATRIX

The turf reinforcement matrix (nylon fiber mat) shall meet the requirementsidentified in Section 02933.

2.3 GRANULAR BACKFILL

The granular backfill materialfor the reinforced backfill soils indicated shall conform to the requirements of Section 4133, Gradation 32, for granular backfill material of the Standard Specifications for Highway and Bridge Construction of the Iowa Department of Transportation.

2.4 REINFORCED SLOPE FILL

Reinforced slope fill materials for the reinforced and retained backfill material shall include materials classified in ASTM D 2487 as GW, GP, SW, SP and GM, GC, SLY, SC, CL (less than 75 percent passing the number 200 sieve) and soils with a PI less than or equal to 25. Material shall be free from roots, trash, debris, organic matter, frozen material, and stones larger than 3 inches in any dimension.

2.5 SOIL REINFORCEMENTS

Structural geogrid reinforcement elements shall consist of a regular integraily connected longitudinal and transverse polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil, aggregate, or other fill material.

PART 3 EXECUTION

3.1 DELIVERY, HANDLING, AND STORAGE

During all periods of shipment and storage, the geogrid and turf reinforcement matrix shall be protected from prolonged periods of direct sunlight, and protected from temperatures greater than 140 degrees Fahrenheit and below 20 degrees Fahrenheit or as recommended by the manufacturer. The Contractor shall inspect the geogrid and turf reinforcement matrix upon delivery to assure that the proper material has been received and is undamaged. The materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Rolled materials shall be laid flat or stood on end when stored. The Contractor shall prevent excessive mud, wet cement, epoxy, and like materials, which may affix themselves to the guidework, from coming in contact with the materials. The materials shall not be dragged or dropped.

3.2 ON-SITE REPRESENTATIVE

The geogrid reinforcement material manufacturer shall provide a qualified and experienced representative on site, for a minimum of three days, to assist the Contractor and Contracting Officer at the start of construction. The representative shall also be available on an as-needed basis, as requested by the Contracting Officer, during construction of the remaining slope.

3.3 EXCAVATION

The Contractor shall excavate to the lines and grade shown on the drawings or as othervise required to safely construct the reinforced slope as designed. The Contracting Officer will inspect and approve the excavation prior to placement of the bottom most geogrid layer or fill soils. Any soft areas, as determined by the Contracting Officer, shall be excavated and replaced with granular material. The granular material shall be placed and compacted to 95 percent of maximum density (ASTD D 698). The backcut shall be benched into undisturbed embankment material where this procedure can be safely performed.

3.4 GEOGRID INSTALLATION

3.4.1 Geogrid shall be installed in accordance with the manufacturer's recommendations. Geogrid reinforcement shall be placed at the elevations and to the extent indicated on the installation drawings prepared by the slope design engineer or as directed by the Contracting Officer.

3.4.2 Geogrid reinforcements shall be placed in continuous, longitudinal strips in the direction of main reinforcement. Spliced connections between shorter pieces of geogrid will not be allowed.

3.4.3 Adjacent rolls of geogrid used as face wrap shall be overlapped a minimum of 4 inches or mechanically connected.

3.4.4 The amount of geogrid placed shall; be limited to the amount required for immediately pending work to prevent undue damage. After a layer of geogrid has been placed, the next succeeding layer of soil shall be placed and compacted. After the specified soil layer has been placed, the next geogrid layer shall be installed. The process shall be repeated for each subsequent layer of geogrid and soil.

3.4.5 Geogrid shall be placed to lay flat and pulled tight prior to backfilling. After a layer of geogrid has been placed, suitable means, such as pins or small piles of soil, shall be used to hold the geogrid in position until the subsequent soil layer can be placed. Under no circumstances shall a track-type vehicle be allowed on the geogrid before at least 6 inches of soil has been placed.

3.4.6 During construction, the surface of the fill shall be kept approximately horizontal. Geogrid shall be placed directly on the compacted horizontal fill surface. Geogrid is to be placed within 3 inches of the design elevations and extend to the length as shown, unless otherwise directed by the Contracting Officer. Correct orientation of the geogrid shall be verified by the Contractor.

3.5 BACKFILL PLACEMENT

3.5.1 Reinforced slope fill placement and compaction shall be as follows * The maximum lift thickness before compaction shall not exceed 8 inches where heavy compactors are used,and 4 inches where manual compactors are used. regardless of vertical spacing between layers of soil reinforcements. Reinforced backfill material shall have a placement * moisture content less than or equal to the optimum moisture content. The * Contractor shall decrease the lift thicknesses, if necessary, to obtain a density of at least 92 percent of maximum density (ASTM D 698). Backfill material placed within the reinforced soil mass which does not meet the requirements of this specification shall be corrected or removed and replaced at the Contractor's expense, as directed by the Contracting Officer.

3.5.2 Granular backfill shall be compacted to 95 percent of maximum * standard density (ASTM D 698). Reinforced backfill material shall have a * placement moisture content less than or equal to the optimum moisture * content. The maximum lift thickness before compaction shall not exceed * 8 inches where heavy compactors are used and 4 inches where manual * compactors are used regardless of the verti calspacing between layers of * soil reinforcements. The Contractor shall decrease this lift thickness, * if necessary, to obtain the specified density. Results of all testing * performed for placement of backfill shall be provided within 2 days of * completion of test. *

3.5.3 Backfill shall be placed, spread,and compacted in such manner that * minimizes the development of wrinkles in or movement of the geogrid. If materials should be damaged, that damage shall be repaired or the materials replaced, as directed by the Contracting Officer, at no additional cost to the Government.

3.5.4 Tracked construction equipment shall not be operated directly upon * the geogrid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.

3.5.5 Rubber-tired equipment may pass over geogrid reinforcement at * slow speed (less than 10 mph) only if recommended by the manufacturer. Sudden braking and sharp turning shall be avoided.

3.5.6 Backfill shall be graded away from the slope crest and rolled at * the end of each workday to prevent ponding of water on the surface of the reinforced soil mass. The Contractor shall not allow surface runoff from adjacent areas to enter the slope construction site.

3.6 QUALITY CONTROL

The Contractor shall establish and maintain quality control for the segmental concrete retaining wall systems construction. Each sample for compaction tests specified below shall be classified in accordance with ASTM D 2487. The Contractor shall determine the liquid limits, plastic limits, plasticity indices and gradations necessary for such classification in accordance with the requirements of ASTM D 4318. All tests shall be performed by and at the expense of the Contractor by an independent laboratory. Copies of the test results shall be furnished directly to the Contracting Officer by the independent laboratory. Tests shall be performed by and at the expense of the Contractor. The Contracting Officer reserves the right to direct the location and select the material for samples to be tested. Field moisture-density tests shall be performed when and where directed. The following testing rates are the minimum and if, in the opinion of the Contracting Officer, compacted fill of an acceptable quality is not being obtained, increased testing rates will be required. Tests of materials which do not meet the specified requirements will not be counted as part of the tests required. Additional testing, as determined by the Contractor, shall be performed to provide necessary quality control.

a. Compaction Tests: For each field in-place density test taken, the testing laboratory shall make sufficient moisture density relations (ASTM D 598) compaction tests to determine maximum density *

b. In-Place Density Tests: Thetesting Laborat ory shall run not less than two field in-place density test for each 2 vertical feet of fill placed per400 linearfeet of slope (ASTM D 2167 or ASTM D 1556) or portion thereof. When using the Sand-Cone Method, the sand shall be calibrated for each test accomplished. *

c. Minus 200 Wash and Gradation Test: The testing laboratory shall run at least one minus 200 wash and gradation test (ASTM D l14) for each 1,000 cubic yards or portion thereof of granular backfil1 (in-place measure). *

A copy of these records and tests, as well as the records of corrective actions taken shall be furnished the Contracting Officer and CEXR-ED-G as directed by the Contracting Officer.

3.7 MEASUREMENT AND PAYMENT

3.7.1 Measurement: Measurement of the reinforced soil slope system will be based upon a vertical square foot basis as computed from the top of the bike path tothe bottom geogrid layer times the applicable length of section.

3.7.2 Payment for Reinforced Soil Slope System: Payment for the reinforced soil slope system will be made at the contract unit price per square foot for Item No. 0025, "Reinforced Soil Slope System, RS No. 2". Payment shall be considered full compensation for all plant, equipment, labor, materials, supplies, and performing all design, testing, and operations necessary for the complete and satisfactory installation of the reinforced soil siope system. No allowance will be made for material in overlaps. No separate payment will be made for excavation of existing soils, stripping, or subgrade preparation for the geogrid and all costs in connection there with will be considered as a subsidiary obligation of the Contractor. Excavation of any unsuitable materials below the bottom geogrid elevations shown and replacement with granular backfill, as directed by the Contracting Officer, shall be paid for in accordance with the Contract Clause entitled CHANGES. No separate payment will be made for filling or backfilling, except as specified above. No measurement or payment will be made for geogrid replaced because of damage due to the fault or negligence of the Contractor. No measurement or payment will be made for geogrid placed outside of the neat line dimensions shown on the drawings unless such placement has been approved bv the Contracting Officer

3.7.3 Payment for Services of Geogrid Reinforcexnent Material Supplier's On-Site Representative: Payment for the services of the geogrid reinforcement material supplier's on-site representative will be made at the applicable contract unit price per day for the following items of the bidding schedule:

Item No. 0026AA	Geogrid Reinforcement Material Manufacturer's On-Site Representative, First 3 Days
Item No. 0026AB	Geogrid Reinforcement Material Manufacturer's On-Site Representative, Over 3 Days

MECHANICALLY STABILIZED EARTH TECHNOLOGIES APPLIED TO SEGMENTAL RETAINING WALL AND STEEPENED SLOPES

Proposal to HQUSACE to fund ETL and Guide Specification Development

Background: CEMVP submitted a proposal through MVD to develop guide specifications for Mechanically Stabilized Earth (MSE) Segmental Retaining Walls and Steepened Slopes. The basis of this work is the experience gained through using these technologies for a number of projects within the District. MVD supported this work in a memo to HQUSACE and recommended that an Engineering Technical Letter (ETL) be developed in addition to the guide specifications. It is anticipated that this ETL will focus on factors specific to Corps work: Government Contracting, flooding, shoreline protection, and Corps design factors of safety.

Guide Specs

(1) Segmental Concrete Retaining Walls; (2) Reinforced Steepened Slopes

	Task's	MH
1.	Incorporate the 3 bidding options, discussed in the paper by Meyers, et.al., in the guide specification for designers to select appropriate method for their project.	70
2.	Modify the MSE wall and Slope specs to fit the guide spec format.	16
3.	In-house review by Geotech, Specs and Chief, PE-D (12hrs); MVD (12hrs)	24
4.	Peer Review - 2 Industry leaders: 10%, 50% and 90% product reviews and input.	32

ETL

Geosynthetic Reinforcement for Segmental Retaining Walls and Steepened Slopes

5.	Purpose; Applicability; References; Background; Specifying and Bidding; Action to be taken.	6
6.	Appendix A: References (and review of newest references)	32
7.	Appendix B: Technical Guidance [illegible]	[illegible]

	d. MSE Wall and Slope Design (Concentrate on external, compound and global stability procedures and recommend design factors of safety. Internal design procedures will be referenced to).	
8.	Appendix C: Examples	24
9.	In-house review by Geotech and Chief, PE-D (20hrs); MVD (12hrs)	32
10.	Peer Review - 2 Industry leaders: 10%, 50% and 90% product reviews and input	60

Corps of Engineers MVP and MVD: 352 hrs x $85/hr = $29,920
Industry Peer Review: 92 hrs x $100/hr = $9,200 + $3,000 travel costs

Total Product Cost estimated at $42,120. Industry is considering cost sharing this developement and would likely cover the peer review costs with a potential to fund 50% of the total cost.

CEMVD-ET-ET 4 March 1998

MEMORANDUM FOR HQUSACE, ATTN: CECW-EP

SUBJECT: Recommendation No. 12, CSI/SAME Federal Specifications Competition and Award

1. This is a recommendation of the Corps Specifications Steering Committee to support the establishment of an annual jointly sponsored Construction Specifications Institute (CSI) and Society of American Military Engineers (SAME) federal specifications competition and award.

2. PROBLEM: CSI sponsors an annual competition that recognizes specifications packages that are prepared in a manner that most fully complies with CSI Recommended Practices and Procedures as stated in the CSI Manual of Practice. However, these evaluation criteria are not fully adaptable to federal specifications packages prepared with federal guide specifications and SPECSINTACT software in a manner to comply with the Federal Acquisition Regulation.

3. RECOMMENDATION: The Corps Specifications Steering Committee recommends that HQUSACE express to the SAME and the CSI its support for the establishment of a federal specifications competition with appropriate awards. The evaluation criteria for the competition to be determined by a joint CSI/SAME awards committee in view of the differences between the private sector and federal agencies in preparing specifications packages.

4. BACKGROUND AND DISCUSSION: Federal specifications are prepared in a different environment from the private sector. The federal agency requires the use of guide specifications that incorporate requirements of the FAR and the use of SPECSINTACT software to verify that specifications have been correctly prepared. Further, federal specifications do not completely adhere to the CSI recommended practices and formats in the CSI Manual of Practice. A relationship between SAME, a professional organization with many members from federal agencies, and CSI would encourage federal agencies to comply with CSI recommended practices for construction specifications. Such compliance would reduce the cost of facilities procured through the bidding process. An awards program would encourage federal participants to produce higher quality project specifications.

Freddie S. Rush, Chairman
Corps Specifications Steering Committee

US Army Corps of Engineers
Pittsburgh District

Proposal for Preparation of Guide Specification Concrete Restoration (CW Structures)

March 1998

Proposal for Preparation of Guide Specification
Concrete Restoration (CW Structures)

1. SCOPE:

The Pittsburgh District proposes to prepare the guide specification using in-house personnel, with input and review by additional LRP personnel and personnel from other districts, divisions, laboratories and industry as appropriate. Other districts and divisions will be contacted for previously used specifications and nominations for reviewers. An Independent Technical Review will be performed by personnel selected during the research phase. Reviews will be conducted using .PDF format for ease of data interchange. The final guide specification will be prepared in SPECSINTACT (SGML) with a copy also furnished in .PDF format.

2. TEAM MEMBERS:

The team proposed for drafting the subject guide specification is as follows:

Name	Location	Area Of Expertise
Thomas Andre	Pittsburgh District	Specifications: Format and Editing
Anton Krysa	Pittsburgh District	Structural: Concrete Removal, Anchorage and Reinforcement
Carol L. Tasillo	Pittsburgh District	Materials: Repair Materials and Placement Procedures

3. PLAN:

The proposed plan for preparation of the guide specification is as follows:

a. Research - Send out memo requesting sample specifications from other districts and divisions. Review existing USACE guidance documentation (EM's, ETL's, etc.), technical report documentation (TR's), industry technical specifications, specifications from past concrete restoration projects, and specifications from other Corps of Engineers concrete restoration projects. Assemble data and discuss key specification requirements with industry consultants and personnel from other districts and laboratories with technical expertise in concrete restoration.

b. Preparation of Draft Specification - Develop draft specification based on technical information and other districts' recommendations. The specification will be prepared in CSI 3-part format and comply with the guidelines in the document "Preparation of COE Guide Specifications for Military Construction (CEGS)".

c. Review of Draft Specification - Perform in-house review and resolve comments. This review will include Pittsburgh District engineering and construction personnel with substantial experience in concrete restoration. After completion of the in-house review and revision of the specification, an Independent Technical Review of the draft specification will be performed. The Independent Technical Review will include personnel from other districts with substantial experience in concrete restoration. Comments will be assembled and the draft specification will be revised.

d. On-board Review in Vicksburg MS - Meet with appropriate technical representatives to present and review the draft specification.

e. Submission of Final Specifications - Submit the specification for final review and approval. Final specification will be prepared in SPECSINTACT (SGML) format.

4. RESUMES

The District resume and resumes of principal authors are attached.

5. TIME AND COST PROPOSAL:

The attached table shows the time and cost estimate anticipated for the completion of this guide specification. The completion dates for each activity and the final delivery of the guide specification will be based on the duration of each activity and when a notice to proceed is issued to LRP.

U.S. ARMY CORPS OF ENGINEERS
PITTSBURGH DISTRICT
EXPERIENCE WITH CONCRETE RESTORATION

The Pittsburgh District is only one of thirty-eight engineering districts within the U.S. Army Corps of Engineers; however the Pittsburgh District is responsible for 23 lock and dam structures which is 11% of the total number in the nation. The average age of the District locks and dams is over 50 years old, the oldest being built in 1906. In addition, the Pittsburgh District is responsible for 16 reservoir, 8 of which are concrete structures. The average age of the concrete reservoir dams is over 40 years old, the oldest being built in 1938. Maintaining these structures has given the District a vast amount of experience in the area of concrete restoration.

The Pittsburgh District has recently completed two major construction projects and is developing the plans and specifications for two more replacement projects. However, given tighter funding constraints, more emphasis is being placed on maintaining existing projects and making the most of operation and maintenance dollars. In the past 20 years, the Pittsburgh District has rehabilitated several lock chambers of older projects, and has gained extensive experience in removal and replacement of deteriorated concrete. Currently, the Pittsburgh District is conducting rehabilitation projects on two reservoir dam service bridges, as well as extensive rehabilitation of the Johnstown Channel Improvement Project in Johnstown, Pennsylvania. The Johnstown project involves repair of over 9 miles of channel consisting of a combination of walls and slope lining.

A list of recent major projects associated with the repair and rehabilitation of the District's projects is shown below. Minor repairs have also been performed associated with walls, esplanades, sluices, valve and gate recesses, etc. on many of the District projects.

Berlin Dam - Service Bridge (in-progress)
Mahoning Creek Dam - Service Bridge (in-progress)
Johnstown Channel Rehabilitation (in-progress)
Turtle Creek Flood Control Channel (1996)
Allegheny Lock and Dam 4 (1996)
Allegheny Lock and Dam 7 (1994)
Allegheny Lock and Dam 5 (1992)
Dashields Lock and Dam (1990)
Montgomery Lock and Dam (1989)
Emsworth Lock and Dam (1989)
Loyalhanna Lake Dam - Service Bridge (1988)
Kinzua Dam - Stilling Basin Repair (1983)
Monongahela Lock and Dam 3 (1980)

Name: KRYSA, Anton H.

Title: Structural Engineer, Structural and Architectural Design Section, Design Branch, Engineering Division, Pittsburgh District

Education:

1969 B.S. - Civil Engineering, University of Akron
1974-75 One Year Advanced Study Program - Structural Engineering, University of Pittsburgh

Registration:

Professional Engineer, Pennsylvania

Experience:

Twenty-five plus years of experience in various aspects of structural design in the Pittsburgh District of the Corps of Engineers, mostly involving hydraulic structures. In 1973 and 1974 was involved with the use of steel fiber reinforced concrete within the Kinzua Dam stilling basin. Again in 1983, after the first repair was found not to be performing satisfactorily, was involved in the redesign and reconstruction of the same stilling basin. This time over 2000 yards of a silica fume concrete overlay was used to provide resistance against abrasion-erosion damage within the stilling basin. After nearly 20 years this repair has been performing satisfactorily. Involvement included the development of unique specifications for inclusion within the construction contract which were based on evaluations of large scale test placements at two field sites from which unique batching, placing and finishing techniques were identified. This project was the first large scale use of silica fume within the Corps and involved considerable coordination among the silica fume suppliers, WES and other Corps districts. From 1977 to 1987 was involved with several rehabilitation projects for existing navigation locks that required the removal of deteriorated concrete surfaces, replacing with new concrete overlays on horizontal and the refacing of vertical surfaces of lock walls. Have had articles published in trade magazines on the rehabilitation and restoration of concrete.

Name: TASILLO, Carol L.

Title: Civil Engineer, Engineering Division, Geotechnical Branch, Soils Section, Pittsburgh District

Education:

1981 B.S. Civil Engineering, University of Pittsburgh
1995 M.S. Civil Engineering Materials, Purdue University

Registration:

Professional Engineer, Pennsylvania

Experience:

Has over 16 years engineering experience, the past eight years with the U.S. Army Corps of Engineers, Pittsburgh District. Responsible for providing support services to 16 flood control reservoirs and 23 river navigation locks and dams, including construction material and geotechnical aspects for new construction as well as investigating operational problems, evaluating conditions, and making recommendations for repair, rehabilitation and maintenance of existing projects.

As Lead Engineer for concrete materials in Engineering Division, responsible for concrete requirements including materials and placement procedures for a wide variety of concrete repair projects and new construction. Material requirements include investigating and evaluating concrete requirements, selecting appropriate materials, and developing specifications. Placement procedures include evaluating cast-in-place, underwater or tremie-fill placement with respect to site conditions, placement sequence, time constraints and other logistical considerations. Also responsible for evaluating existing concrete conditions for navigational lock and dam structures and reservoir dams.

Larger projects include Johnstown Channel Rehabilitation (on-going), Mahoning Service Bridge Repair (on-going), Berlin Service Bridge Replacement (on-going), Allegheny Lock 4 Rehabilitation (completed 1996), Grays Landing Lock and Dam New Construction (completed 1995), Point Marion Lock Replacement (completed 1994), Allegheny Lock 7 Rehabilitation (1994).

Name: ANDRE, Thomas E.

Title: Civil Engineer, Technical Contracts Support Section, Design Branch, Engineering Division, Pittsburgh District

Education:

1974 B.S. Civil Engineering, Geneva College
1983 M.S. Industrial Engineering, University of Pittsburgh

Registration:

Professional Engineer, Pennsylvania

Experience:

Twenty-three years experience as a Specifications Engineer. Responsible for preparing, correcting and reviewing construction specifications, including construction and rehabilitation of navigation structures, local flood protection projects, and recreational facilities; reviewing specifications prepared by A-E's and other Corps of Engineers Districts for the District. Specifications have been prepared utilizing SPECSINTACT since 1989. Major specification projects have included Rehabilitation of Locks and Dam 3, Monongahela River (1978), Emsworth Locks and Dams (1981), Montgomery Locks and Dam (1985), and Dashields Locks and Dam (1987), Ohio River; Construction of Stonewall Jackson Dam (1983), Grays Landing Lock (1990), Point Marion Lock (1990), Grays Landing Dam (1993), Monongahela River, Channel Rehabilitation, Turtle Creek Local Protection Project (1994), and Channel Rehabilitation, Johnstown Channel Improvement Project (1996-present).

Previous experience with updating and reviewing of guide specifications and other technical criteria includes updating CW-09940 “Painting: Hydraulic Structures” (1988-1989), preparation of a model specification for maintenance painting for Ohio River Division (1986) based on Civil Works guide specifications to address conditions unique to the Division facilities; review of “Guide Specification for Asbestos Abatement” (1988); review of Draft ER 1110-2-1200 “Engineering Design Plans and Specifications” (1991); review of EC 1110-1-79 “Environmental Protection Guide Specifications” (1994); and review with of Draft EM 1110-2-3400 “Painting: New Construction and Maintenance” (1994). Currently designated as Notice Program Technical Representative for CWGS 05036 "Metallizing: Hydraulic Structures".

Concrete Restoration (CW Structures)
Time and Cost Proposal

Activity	Duration of Activity (days)	Responsible Party	Cost
Solicit and receive specifications from other USACE Districts and Divisions	30	Andre	$600
Review existing USACE and industry guidance and documentation, in-house specifications, and specifications received from other Districts	45	Team	$7,800
Develop draft specification format,outline and sections	1	Andre	$800
Develop draft guide specification	45	Team	$16,000
In-house review and resolution of comments	30	Team and internal reviewers	$10,800
Independent Technical Review and resolution of comments	30	Team and Independent Technical Reviewers	$4,800
Onboard review in Vicksburg, MS	2	Team	$4,800
Submit draft to HQUSACE for review and comment	1	Andre	$300
HQUSACE review and approval	30	CECW-E	$0
Resolve comments and submit final guide specification	30	Team	$5,400
Travel & Per Diem		Team	$1,900
TOTALS	244		$53,200

US Army Corps
of Engineers
Pittsburgh District

Proposal for Preparation of Guide Specification
Soil and Rock Anchors

March 1998

Proposal for Preparation of Guide Specification
Soil and Rock Anchors

1. SCOPE:

The Pittsburgh District proposes to prepare the guide specification using in-house personnel, with input and review by additional LRP personnel and personnel from other districts, divisions, laboratories and industry as appropriate. Other districts and divisions will be contacted for previously used specifications and nominations for reviewers. An Independent Technical Review will be performed by personnel selected during the research phase. Reviews will be conducted using .PDF format for ease of data interchange. The final guide specification will be prepared in SPECSINTACT (SGML) with a copy also furnished in .PDF format.

2. TEAM MEMBERS:

The team proposed for drafting the subject guide specification is as follows:

Name	Location	Area Of Expertise
Thomas Andre	Pittsburgh District	Specifications: Format and Editing
Anton Krysa	Pittsburgh District	Structural: Soil and Rock Anchors
Andrew Schaffer	Pittsburgh District	Geology: Anchorage in Soil and Rock

3. PLAN:

The proposed plan for preparation of the guide specification is as follows:

a. Research - Send out memo requesting sample specifications from other districts and divisions. Review existing USACE guidance documentation (EM's, ETL's, etc.), technical report documentation (TR's), industry technical specifications, specifications from past soil and rock anchor projects, and specifications from other Corps of Engineers soil and rock anchor projects. Assemble data and discuss key specification requirements with industry consultants and personnel from other districts and laboratories with technical expertise in soil and rock anchors.

b. Preparation of Draft Specification - Develop draft specifications based on technical information and other districts' recommendations. The specification will be prepared in CSI 3-part format and comply with the guidelines in the document "Preparation of COE Guide Specifications for Military Construction (CEGS)". Communications will continue with local and national construction and Architect-Engineering companies specializing in anchor design and installation to insure that the specification reflects current industry standards and practices.

c. Review of Draft Specification - Perform in-house review and resolve comments. This review will include Pittsburgh District engineering and construction personnel with substantial experience in soil and rock anchors. Pittsburgh District Construction Division personnel have had first hand knowledge of the consequences of the past specification requirements and the ability of the Contractors to provide materials to meet them. After completion of the in-house review and revision of the specification, an Independent Technical Review of the draft specification will be performed. The Independent Technical Review will include personnel from other districts with substantial experience in soil and rock anchor design and installation. Comments will be assembled and the draft specification will be revised.

d. On-board Review in Vicksburg MS - Meet with appropriate technical representatives to present and review the draft specification.

e. Submission of Final Specifications - Submit the specification for final review and approval. Final specification will be prepared in SPECSINTACT (SGML) format.

4. RESUMES

The District resume and resumes of principal authors are attached.

5. TIME AND COST PROPOSAL:

The attached table shows the time and cost estimate anticipated for the completion of this guide specification. The completion dates for each activity and the final delivery of the guide specification will be based on the duration of each activity and when a notice to proceed is issued to LRP.

U.S. ARMY CORPS OF ENGINEERS
PITTSBURGH DISTRICT
EXPERIENCE WITH SOIL AND ROCK ANCHORS

The first known use of stressed bars or anchors in the District was for a Sidney type tainter gate at Emsworth Dam in the early 1930's. The gate was an experimental design whereupon modified designs were eventually adopted throughout the Corps. Stressing of bars was a technique used to attain a prestressed force within the gate anchorage. This is essentially the same type of mechanism used today for soil and rock anchor designs. The District's experience has been primarily been with rock, rather than soil, anchors which begun in the sixties with the design of anchors for flood protection structures. Over the last forty years, the District has designed and constructed numerous rock anchors of all types and variety for hydraulic structures. These primarily encompassed permanent anchors for new flood protection retaining structures and the stabilization of existing navigation locks and dams. Temporary anchors were often used to provide additional stability for cofferdams. The following is a list of projects where anchors were used.

Project	Type Bar (B) Strand (S)	Temporary (T) Permanent (P)
Chartiers Creek Flood Protection Project	B	P
Johnstown Flood Protection Project	B	P
Girtys Run Flood Protection Project	B	P
Oil City Ice Control Structure	S	P
Hannibal Dam Cofferdam	S	T
Point Marion Lock and Dam	S&B	T
Grays Landing Dam	S	T
Stonewall Jackson Dam	B	T
Hildebrand Dam	S	P
Lock 3, Monongahela River	B	P
Emsworth Lock Rehabilitation	B	P
Dashields Lock Rehabilitation	S&B	P
Montgomery Lock Rehabilitation	S&B	P
Lock 2, Mon River Abutment(Under Contract)	S	P

The Pittsburgh District has maintained close communications with local construction and Architect-Engineering companies specializing in anchor design and installation. These companies have designed and/or installed a wide variety of soil and rock anchors within Pennsylvania, Ohio and West Virginia for public agencies, as well as for the private sector.

Name: KRYSA, Anton H.

Title: Structural Engineer, Structural and Architectural Design Section, Design Branch, Engineering Division, Pittsburgh District

Education:

1969 B.S. Civil Engineering, University of Akron
1974-75 One Year Advanced Study Program - Structural Engineering, University of Pittsburgh

Registration:

Professional Engineer, Pennsylvania

Experience:

Twenty-five plus years of experience in various aspects of structural design in the Pittsburgh District of the Corps of Engineers, mostly involving hydraulic structures. Recently involved in the design of abutment walls for the Locks and Dam No. 2 project where drilled caissons were required as the primary element for founding and stabilizing the walls. These caissons are to be installed immediately adjacent to and on the river and, in one section, rock anchors are required for additional stability. Experience from 1989 to 1994 included serving as Technical Manager of the Point Marion Lock project which encompassed the construction of a new $110 million dollar lock adjacent to an existing old lock. This work involved the use of 500 large capacity prestressed anchors to stabilize 1700 linear feet of existing lock wall. Was involved in critical field reviews during construction to assure the continued safe operation of the adjacent existing lock. Have had extensive experience in the design of steel sheet pile cofferdam structures and have been involved with unique designs where the cofferdams were required to be stabilized using rock anchors. From 1974 to 1989, designed rock anchors for the Lock and Dam No. 3 and Emsworth Lock wall stabilizations, the Oil City ice control structure, and the Point Marion and Hildebrand navigation dams. Recently provided technical review comments for the Johnstown project that encompassed the rehabilitation of existing flood walls using rock anchors. Contributed to ETL 1110-2-310, “Stability Criteria for Existing Concrete Navigation Structures on Rock Foundations, dated 17 Dec 87, wherein guidance was provided on the use of non-prestressed anchors.

Name: SCHAFFER, Andrew

Title: Civil Engineer, Geology Section, Geotechnical Branch, Engineering Division, Pittsburgh District

Education:

1981 B.S. Geological Engineering, University of Arizona
1985 M.S. Geological Engineering, University of Arizona

Registration:

Professional Geological Engineer, State of Arizona

Experience:

Technical reviewer of plans and specifications and design memorandums including rock anchor designs for Johnstown, PA Flood Protection Project and McAlpine L/D, Louisville District. Ten years District experience in subsurface exploration, sampling of rock core for foundation evaluation, and laboratory testing of rock, including the determination of rock anchor bond strengths. Involved in the drilling and grouting of rock anchors for the Point Marion L/D cofferdam. Responsible for preparation of geological aspects of plans and specifications including Section 02164, “Rock Anchors”.

Name: ANDRE, Thomas E.

Title: Civil Engineer, Technical Contracts Support Section, Design Branch, Engineering Division, Pittsburgh District

Education:

1974 B.S. Civil Engineering, Geneva College
1983 M.S. Industrial Engineering, University of Pittsburgh

Registration:

Professional Engineer, Pennsylvania

Experience:

Twenty-three years experience as a Specifications Engineer. Responsible for preparing, correcting and reviewing construction specifications, including construction and rehabilitation of navigation structures, local flood protection projects, and recreational facilities; reviewing specifications prepared by A-E's and other Corps of Engineers Districts for the District. Specifications have been prepared utilizing SPECSINTACT since 1989. Major specification projects have included Rehabilitation of Locks and Dam 3, Monongahela River (1978), Emsworth Locks and Dams (1981), Montgomery Locks and Dam (1985), and Dashields Locks and Dam (1987), Ohio River; Construction of Stonewall Jackson Dam (1983), Grays Landing Lock (1990), Point Marion Lock (1990), Grays Landing Dam (1993), Monongahela River, Channel Rehabilitation, Turtle Creek Local Protection Project (1994), and Channel Rehabilitation, Johnstown Channel Improvement Project (1996-present).

Previous experience with updating and reviewing of guide specifications and other technical criteria includes updating CW-09940 “Painting: Hydraulic Structures” (1988-1989), preparation of a model specification for maintenance painting for Ohio River Division (1986) based on Civil Works guide specifications to address conditions unique to the Division facilities; review of “Guide Specification for Asbestos Abatement” (1988); review of Draft ER 1110-2-1200 “Engineering Design Plans and Specifications” (1991); review of EC 1110-1-79 “Environmental Protection Guide Specifications” (1994); and review with of Draft EM 1110-2-3400 “Painting: New Construction and Maintenance” (1994). Currently designated as Notice Program Technical Representative for CWGS 05036 "Metallizing: Hydraulic Structures".

Soil and Rock Anchors
Time and Cost Proposal

Activity	**Duration of Activity (days)**	**Responsible Party**	**Cost**
Solicit and receive specifications from other USACE Districts and Divisions	30	Andre	$600
Review existing USACE and industry guidance and documentation, in-house specifications, and specifications received from other Districts	45	Team	$13,200
Develop draft specification format,outline and sections	1	Andre	$800
Develop draft guide specification	45	Team	$10,000
In-house review and resolution of comments	30	Team and internal reviewers	$10,800
Independent Technical Review and resolution of comments	30	Team and Independent Technical Reviewers	$4,800
Onboard review in Vicksburg, MS	2	Team	$6,000
Submit draft to HQUSACE for review and comment	1	Andre	$300
HQUSACE review and approval	30	CECW-E	$0
Resolve comments and submit final guide specification	30	Team	$6,000
Travel & Per Diem		Team	$1,900
TOTALS	244		$54,400

CELRD-OR-ET-E 20 March 1998

MEMORANDUM FOR Mr. Larry Seals
THRU Mr. Ron ~~Yates~~

SUBJECT: Rock and Soil Anchor Guide Specification Proposal

1. The time and cost estimate for the subject proposal is attached. Also included are resumes for the Principal Investigator Mr. Mosaid AL-Hussaini and co-investigator Ms. Fran Robinson.

2. Please direct any questions to Mr. AL-Hussaini at (513) 684-3028.

E. Frances Robinson

E. FRANCES ROBINSON, P.G.
CELRD-OR-ET-E

ENCLOSURE 12

CELRD-OR-ET-E 11 Feb. 1998

MEMORANDUM FOR: Mr. Larry Seals
SUBJECT: Rock and Soil Anchors Guide Specification

1. The agenda and budget is based on the assumption that the starting date is 15 April 1998. Actual date will depend on the approval of the fund of the guide specification.

Activity	Completion date	Responsible party	Cost
Memorandum to all MSC's and Districts requiring copies of their current specification	15 April 98 Memo with a 30 April 98 suspense	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 0
Accumulate and chronicle various Division and District specifications	1 May 98 through 1 June 98	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 3,000
Memorandum to all MSC's and District requesting nominees to be on review committee of the subject specification	15 May Memo with a 1 June 98 suspense	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 0
Select committee members and obtain HQUSACE approval	4 June 98 through 19 June 98	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 0
Develop draft format, outline and sections to be approved by the committee	1 July 98 through 15 July 98	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 3,000
Develop Draft Specification.	16 July 98 through 30 September 98	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 28,000
Send copy of Draft Specification to the committee members for review and comments	1 October 98 through 15 October 98	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 0
Revise the Draft Specification according to committee members comments	16 October 98 through 30 October 98	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 4,000
Send copy of the revised Draft Specification to all MSC's and Districts requesting comments	2 November 98 through 16 November 98	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 0
Assimilate comments and revise draft	17 November 98 through 2 December 98	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 4,000
Submit final Draft Specification To HQUSACE for review and approval	3 December 98 through 21 December 98	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 0
Meeting at HQUSACE to resolve comments	22 December 98	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 1,500
Place final copy in Specsintact format	23 December 98 through 15 January 99	Al-Hussaini and Robinson CELRD-OR-ET-E	$ 2,000
Printing and Distribution	19 January 99		$ 4,500

2. The above agenda provides a time frame of 9 months at a cost of $50,000.
3. Resumes for responsible parties are attached.

Mosaid AL-Hussaini , PE
CELRD-OR-ET-E

RESUME

MOSAID M. AL-HUSSAINI, PhD, PE

Current Duty:

Serves as the Division Technical Specialist on geotechnical and material engineering matters related to embankments, foundations, and other earth and concrete structures. Provides technical advice in all phases of design, construction and modification of earth structures. Responsible for compliance with material and geotechnical design criteria, guide specification and standards. Reviews and analyzes criteria, design data and specifications as related to QA of districts processes and products. Performs QA oversight. Provides advice to Chief, Engineering Division, other CELRD elements and districts during project planning, design, construction, operation, and rehabilitation. Visits district offices and construction projects to monitor activities to assure product quality and policy compliance. Recent experience in anchors involved design analysis of rock anchor for Bluestone dam, Summers County, WV., and soil anchor for a commercial Project, Napa River, CA.

Academic Experience:

Dr. Al-Hussaini has M.Sc in structural engineering from Virginia Polytechnic Institute and State University, Blacksburg, Virginia, and Ph.D. in geotechnical engineering from Georgia Institute of Technology, Atlanta, Georgia. He was professor of civil engineering at Kuwait and Howard Universities, and Adjunct Professor at Mississippi State University. He taught many undergraduate and graduate courses in structural mechanics, and soil mechanics and foundation engineering.

Previous Experience:

Served more than 15 years as research civil engineer at the Geotechnical Laboratory, WES. Published more than 60 publications including books, journal papers, technical reports, engineering manuals, and guide specifications. Performed tasks for several Engineering Divisions and Districts. Most recently, conducted studies for South Pacific Division, Jacksonville District, and Huntington District. Worked on various geotechnical problems including soil exploration, soil testing and analysis, slope stability and dam safety, soil structure interaction design problems, reinforced earth, seepage problems, and remediation of radioactive waste.

Professional Activities:

Registered professional engineer, and active member of the American Society of Civil Engineers (ASCE) and the American Society for Testing and Materials (ASTM).

NAME: Elizabeth Frances Robinson
POSITION: Geologist GS-1350-13

ORGANIZATION AND LOCATION: (December 1994 – Present) Lakes River Division, Engineering Geology, Engineering and Water Management Division, Engineering and Technical Services Directorate (CELRD-ET-EG), Cincinnati, OH.

EDUCATION: Bachelor of Science in Geology, University of Cincinnati
Master of Science in Environmental Hydrogeology (minor in Civil Engineering), University of Cincinnati

PROFESSIONAL AFFILIATIONS: Registered Professional Geologist:
Indiana, Tennessee and Wisconsin
Member and Officer: Association of Engineering Geologists, National Ground Water Association

CURRENT DUTIES AND RESPONSIBILITIES: Serves as staff specialist in Engineering Geology, general hydrogeology and hydrogeology as related to Hazardous, Toxic and Radioactive Waste. Exercises technical authority over four Ohio River Region districts. Serves as primary point-of-contact for all division (seven districts) in matters related to engineering geology. Responsible for compliance with geological and hydrogeological related criteria, guidance and standards. Reviews and analyzes revised/new criteria, data and policy determinations in quality assurance of district products/processes. Reviews and evaluates design reports, contract plans and specifications and related technical reports specifically as to safety, proper functioning, cost, and constructibility. Reviews and evaluates studies of dam safety, ground water and rock mechanics, including rock bolting and rock slope stability. Reviews and evaluates environmental impact of geotechnical related studies and operations. Provides technical monitoring of projects under construction, identifying geologically related items that differ from design assumptions. Consults with various public and private agencies. Most recently have provided geotechnical expertise related to rock anchor design for the Bluestone Lake Foundation Drain Evaluation as well as providing Independent Technical Review involving rock anchor design in the Plans and Specifications for the Lower Monongahela Dam 2 Abutment/Riverwall project.

PREVIOUS EXPERIENCE: (December 1989 – December 1994) Served five years as Chief, Geology Section, Ohio River Division Laboratory. Responsible for a large number of rock mechanics projects (for seven districts) involving a number of test procedures such as: direct shear, residual shear, rock anchor bond, triaxial and compression. Studied the problems related to bond strength testing and its direct application to field measurements. Have assisted district personnel in resolving rock parameters to be used in design of projects involving dams, lock walls and tie-back walls where rock anchors were utilized.

CECW-EP

31 MAR 1998

MEMORANDUM FOR Chief, Operations Division

SUBJECT: Dredging Guide Specifications

1. This memorandum is to inform you that the 1960 Dredging guide spec is being eliminated from the list of USACE guide specs maintained by HQUSACE.

2. The USACE Specification Steering Committee, by polling the districts, found that the subject guide spec, because of its age, is not being used. Districts that need an up to date dredging spec have developed their own.

3. In light of the above there is no need to expend HQUSACE GE funds to maintain the subject guide spec on the Techinfo web site.

4. My point of contact for this action is Charles Baldi, 761-8894.

STEVEN L. STOCKTON, P.E.
Chief, Engineering Division
Directorate of Civil Works

CELRD-OR-ET-EQ (1110) 23 March 1998

MEMORANDUM FOR Corps Specifications Steering Committee

SUBJECT: Hydraulic Steel Structures Requirements

1. This is an Information Paper.

2. PROBLEM: Additional requirements have been enumerated in EM 1110-2-8157, Responsibility for Hydraulic Steel Structures, dated 31 January 1997, which are not included in the guide specifications pertaining to metals (Section 05101 and 05502) and the various steel structures. These requirements include:

a. Although most connections should be detailed by the design engineer, when connections are to be designed by the fabricator, all required information shall be provided in the plans and specifications (P&S), including design forces for the connection. The engineer must review any fabricator-designed connections to ensure compliance with the design requirements.

b. Material toughness requirements for all fracture critical members (FCM) shall be defined in the specifications.

c. All welds should require at least a visual inspection. Non-destructive testing shall be required of all welds on FCM.

d. All FCM shall be clearly identified on the drawings (to be noted by the specifications writer).

3. RECOMMENDATIONS:

a. The appropriate guide specifications should be revised to include the above requirements. This is not a major effort and should be accomplished by the technical proponent as part of the next notice update.

b. Joe Padula, WES, is revising EM 2105 and is adding an appendix on content requirements for project specifications. The draft 2105 should be used as a resource when the guide specs are updated.

4. BACKGROUND AND DISCUSSION: Although EM 1110-2-2105, Design of Hydraulic Steel Structures, dated 31 March 1993, included fatigue and fracture control requirements, recent incidents have revealed the need for closer attention to these requirements, in particular to the FCM. In 1995 an effort began to inspect all existing FCM. In 1997 the above mentioned ER was published to highlight requirements for every phase from design to construction to operation and maintenance.

ROBERT E. TAYLOR, P.E.
Structural Engineer